SCIENCE

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SOME NEW ELECTRIC MOTORS.

FOR several years past the C. & C. Electric Motor Company have devoted their entire energies to the manufacture of small motors, having built thirty-six hundred motors of ⅛ horse-power, and over five hundred ¼ and ½ horse-power motors. While this company have built motors as large as 5 horse-power, they have not until recently, when the new shops were completed, undertaken to supply those of larger power, their old shops having been fully occupied with orders for small motors.

We recently described their new factory, and since the company moved in, Mr. Lemuel William Serrell has designed for them motors as large as 25 horse-power. The design of these larger motors is shown in the accompanying cuts. Fig. 1 is of a 15 horse-power, Fig. 2 of a 3 horse-power, motor.

The machines present a few peculiarities. The field-magnet cores are drop-forged, are circular in shape, and are concentric with the shaft, being oblong in cross-section, and of a width equal to the axial length of iron in the armature. These cores, when bolted to the base of the pole-pieces, completely surround the armature, which is of the drum type, and in its general proportions resembles a Gramme ring, in which the radial depth is increased until the annular ring reaches the shaft, thus forming a drum armature of large diameter. This form requires little wire, and the air-space resistance between the pole-piece and the armature is reduced to a minimum.

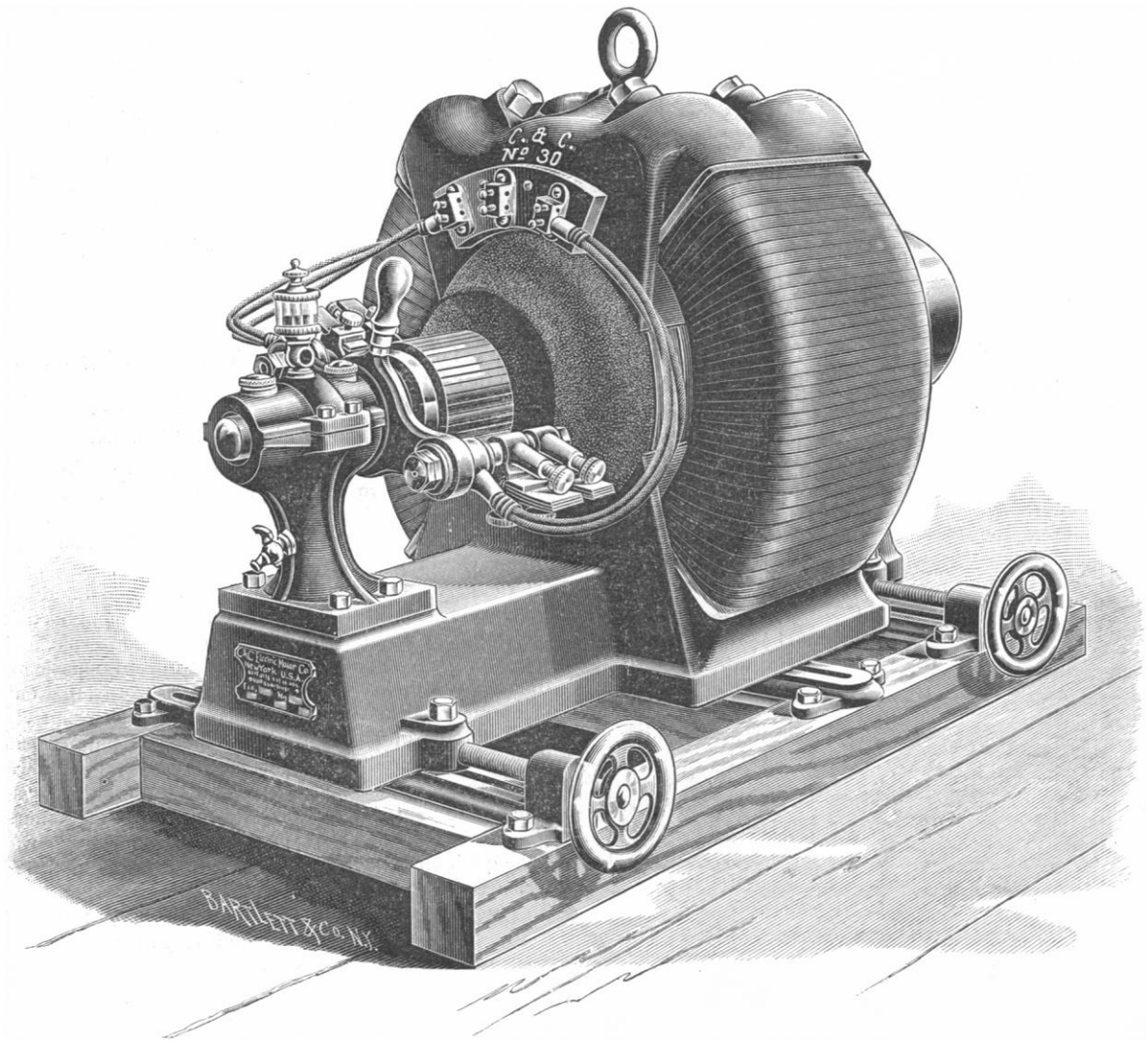


FIG. 1.—FIFTEEN-HORSE-POWER C. & C. MOTOR.

The windings are calculated by dealing with the magnetic circuit as if it were an electric circuit, following Ohm's law: magnetic potential taking the place of volts; and lines of force, current; and the resistance of the iron when below saturation to the flow of

lines of force, the resistance of a wire to an electric current. The shortest possible length for the magnetic circuit is obtained by giving a circular form to the machine. The result shows that the machines have come out very close to their estimated power, the actual number of volts developed being 109 against 110 in a 3-horse power motor. It has been aimed at to eliminate Foucault's currents and undue heating.

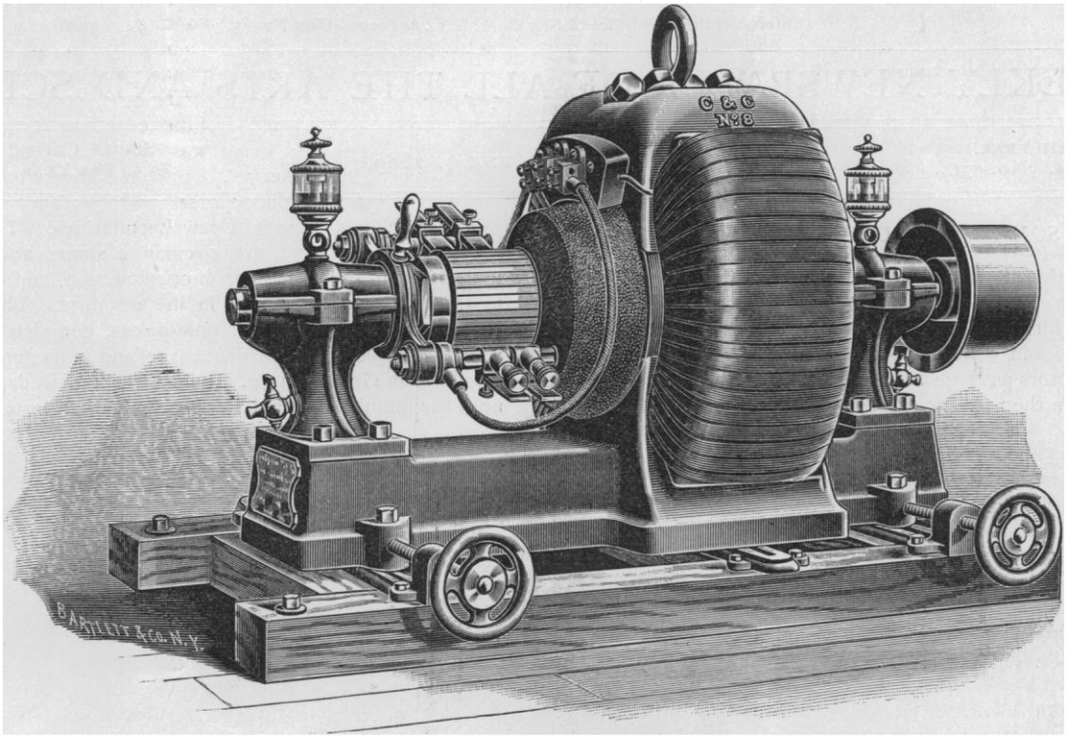


FIG. 2.— THREE-HORSE-POWER C. & C. MOTOR.

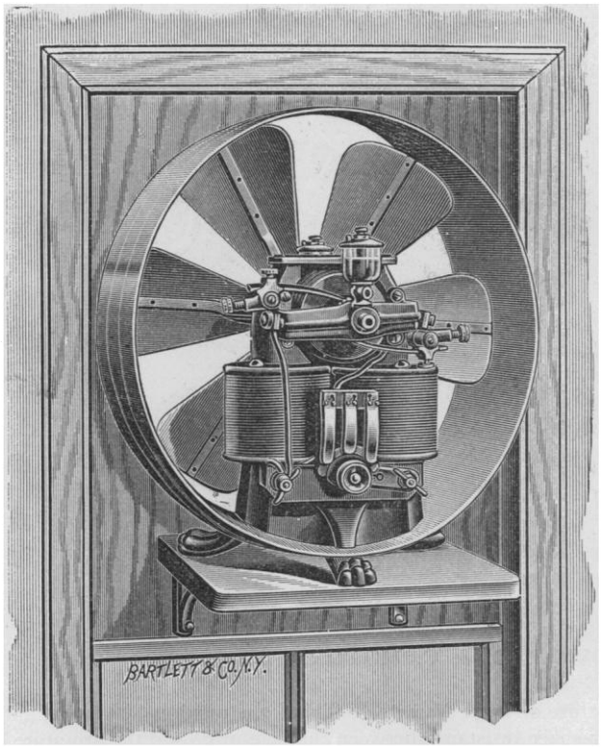


FIG. 3.— THE C. & C. COMPANY'S MOTOR AND EXHAUST FAN.

Another application of this motor is to the driving of ventilating-fans. Fig. 3 shows a ¼-horse-power incandescent motor fan outfit. This apparatus at a speed of one thousand revolutions a minute is claimed to have considerable advantage over most slow-running fans. Two of these fans have been successfully employed to ventilate a hall 100 feet square, being placed opposite each other, and both used as exhausts. Another method employed is to place one of these fans at either end of a hall, one running as an exhaust, and the other forcing air in.

WATER-FILTRATION.

PROBABLY at no time has the condition of the water-supply of our cities and towns received more attention than at present, and perhaps no one thing has conduced to this state of affairs more than the discovery that certain salts contained in the earth act as renovaters of all so-called "spring" waters, purging them, so to speak, of the foul matters held both in solution and in suspension.

Up to the time of this discovery, it was thought that the earth acted merely as a filter or strainer on a large scale, and that each grain or atom of earth acted its part toward opposing or arresting mpurities in the passing water; in other words, that only mechanical straining or filtering took place, and nothing more.

Multitudes of filters have been made and put in operation in all ages and countries with the expectation of seeing the water emerge from them as pure and sparkling as from a good "spring," and the greatest surprise has been manifested at the failure to secure the same results when apparently every condition was supplied. The question remains, "Was every condition supplied?" Modern science answers, "No."

The peculiar action of the above salts upon the portion of impurities said to be held in solution is well illustrated by the effects produced by dissolving soap in a water of great (so called) hardness. The white flakes that almost instantly appear are composed not alone of dissolved soap (for soft water would not show such individualized flakes), but a mixture of soap and some substance hitherto held in undisturbed solution in the water, but now withdrawn from that condition and floating about in mechanical suspension.

It will be plain that if this soap-treated water was now poured into the earth at one point, and made to emerge at another some distance off, it would be found purged of not alone the soap it contained, but also of the modicum of foreign matter held in its embrace, and which went to make up the quality of hardness spoken of.

This subject is so little (generally) understood, that it seems necessary to use the above illustration for the benefit of the casual reader, although to the chemist a hundred different applications of the same law will suggest themselves. Indeed, it is noted here for the purpose of calling more emphatic attention to the simple fact that water may contain impurities in absolute (chemical) solution, and that such impurities, by the addition of another substance, may be rendered tangible, and capable of withdrawal from the water by purely mechanical means.

Equally clear and understood should be the statement that water may contain impurities in a state of fine (mechanical) suspension, — so fine that they would flow wherever water would flow, — and these, by the addition of another substance to the water, be made to flock together into groups, a thousand or two into one (as clouds are condensed into drops); and that one, with its fellows, be tangible, and easily removed from the water by purely mechanical means.

It follows, that if the earth contains in abundance this "substance," which has the dual property of disengaging matter held in solution, and rendering the same tangible, and also of curdling together matter held in so fine a state of division as to almost elude the senses into a state of perfect tangibility, we at once get at the secret of how nature makes the true spring-water, so wonderfully pure and sweet to the taste, as well as brilliantly clear, and inviting to the eye.

What is this substance or substances? Usually some combination of lime, iron, potassium, aluminum, etc., with other bases, such as sulphur or carbon, — all existing naturally in the great mother matrix, the earth.

The almost universal diffusion of the aluminiferous earth (red clay) makes that substance take a more prominent place among the agents above alluded to. Water cannot flow far in any part of the world without encountering in its course the coagulating or curdling effect of this single element. Some of these clays are more heavily charged or freighted with aluminous compounds than others. Waters fouled by such are more quickly subsided. In this fact we have a clew to the explanation of why it is, that, of two different waters showing the same degree of turbidity from clayey impurities, such impurities will subside quickly in one, while in the other they may not subside in months. As proof that the quick subsidence is due to the presence of these salts, we have only to add a minute proportion of such (usually aluminum sulphate) to the other water to produce the same effect. Hence, when water issues from the earth in a very clear and perfect state, we may always be sure that it has encountered somewhere on its travels a body of earth or mineral containing a suitable coagulant, the action of which coagulant upon the water accounts for its wonderful purity aside from and entirely independent of the mere filtering effect of the earth.

It has remained for the present decade to apply the above knowledge to the art of filtration of water, and for the first time produce results equal to nature.

As this industry extends, it will become a common thing to see "spring" water issue from our city faucets, as is already the case in a few American cities, notably Atlanta, Long Branch, and Newport.

The study of this subject furnishes a striking example of Nature's exhibiting, in the humble wayside "spring," the results of her perfect handiwork for the observation and admiration of man throughout all ages and countries, only to deliver up her secret to the pale student of this century of science.

JOHN A. CALDWELL.

THE USE OF SPIRIT AS AN AGENT IN PRIME MOVERS.

A PAPER on the above subject was prepared by A. F. Yarrow at the request of the Council of the London Society of Arts, and was presented May 22. It did not treat of the adoption of spirit or liquid hydrocarbons, such as petroleum, when used as a substitute for coal as fuel, which is an entirely distinct subject, but with the use of volatile liquids in lieu of water, to produce power, when converted by heat from the liquid to the vapor state, in the same way that power is obtained from the conversion of water into steam.

In the year 1856 this subject attracted much attention in France; and, as a matter of fact, several large steamers were built, and ran between Marseilles and Algiers, in which ether was evaporated in combination with steam for working the propelling machinery. The engines were on the Du Tremblay system. The steam, after having performed work in one cylinder, instead of going at once to the condenser, was used to evaporate ether in a tubular evaporator, by which means a portion of the remaining heat in the steam was absorbed instead of being wasted. The ether vapor so produced was used in another cylinder, the additional power thus obtained being a clear gain. These steamers ran, making regular voyages, for some years, but were ultimately abandoned.

The gain obtained is clearly due to the ether taking a portion of the heat of the exhaust steam, and turning it to useful account, which would otherwise be wasted in raising the temperature of the condensing-water. The ether used evaporates at about 104° F.: it will therefore be seen to what a low temperature the steam or water can be brought down, and still be useful in evaporating the ether.

The system was no doubt enconomical as regards fuel; but the ether was so difficult to keep, that a renewal of about one gallon per hour was required to make good the leakages. There was also serious risk of explosion on account of these leakages, because the ether, when free, rapidly vaporizes, and when in this state is explosive if mixed with the atmosphere. The difficulties which at that time had to be dealt with are, however, now greatly reduced. Ether, being the spirit used, was far more costly than other volatile liquids which are available now, and consequently any leakage then represented an important item in the working expenses; also, at that period, means for obtaining good workmanship were not available to the engineer, as they are at present, accuracy of workmanship, and soundness of materials, being essential points in dealing with the vapor of these volatile liquids, as it penetrates joints and castings which no steam would. In fact, an amount of care is necessary beyond what is needed in the best steam-engine practice, and sufficiently good work was not available thirty-two years ago.

The success of some small boats lately built in the United States, propelled by spirit vapor, induced Mr. Yarrow to take the matter up with a view to investigate it, and see whether the results would justify his going fully into the matter with a view to its further development. These preliminary investigations look promising.

The apparatus with which the experiments were tried was a small steam-engine of ordinary construction, which actuates a shaft and fly-wheel in the usual way. There was a brake attached to the shaft, with a spring balance and index; also a revolution counter, so that he was enabled to obtain the actual power developed. There was also fitted to this little engine an ordinary indicator, from which to obtain diagrams.

The steam-boiler had no special feature about it: it had simply a combustion-chamber and a straight flue through to the funnel. There was no attempt at economy of fuel, because there was no object in so designing it, all he wished to obtain being the comparative results on a common basis. The heat was obtained by means of ordinary gas, burnt in a large Bunsen burner. Gas was selected as the means of heating because the exact quantity could be accurately regulated and recorded, and with this view there was attached to the inlet pipe a gas-meter. The exhaust from the cylinder passed out, and terminated in a coil of pipe immersed in a tank of running water for the purpose of condensing the steam. From there the condensed steam ran into a hot-well, and passed on to the feed-pump on the engine, and was forced back into the boiler, so that an entire circuit was made. This completes the arrangement for working the engine by steam.

For the corresponding system, when spirit vapor was used, inside the upper part of the boiler was a copper coil, the inlet to which was at the side, and the outlet at the top, whence it passed to the engine. The exhaust pipe from the cylinder was led in this case into a tank where the vapor was condensed, and passed on to the hot-well, thence to the pump, and was forced back into the coil inside the boiler, thus making this circuit complete. Two sets of pipes, condensing-coils, etc., were adopted, so as to avoid, as far as

practicable, any mixture of water and spirit, which would tend to vitiate the experiments.

The heat from the gas-flame is first taken up by the water in the boiler, and is then passed on to the copper coil, and evaporates the spirit; the water only acting as a convenient means of transmitting the heat from the flame to the spirit. By these means it was possible to try steam and spirit vapor under precisely similar circumstances with regard to boiler efficiency.

The experiments consisted of several continuous trials, each of three hours duration, alternately with steam and with spirit vapor. The upshot of these experiments was, that although the amount of gas consumed during the three hours was practically the same, being at the rate of 82 and 83 cubic feet, the power obtained, as tested on the brakes, was, in the case of spirit, nearly twice that recorded in the case of water, the powers being as 4,722 to 2,524.

At equal intervals during these trials, diagrams were taken with an ordinary indicator. The working-out of these diagrams gives a power, in the case of spirit, of 11,975 foot-pounds per minute, and, in the case of water, of 5,199 foot-pounds per minute, which more than confirms the results obtained by the brake.

Touching the class of spirit used for the experiments, Mr. Yarrow mentioned that it was a hydrocarbon distilled from petroleum, having a specific gravity of about .680. The reason this spirit was adopted was because it is low in price, and can be easily procured; and also, being obtained from petroleum, it is of an oily nature. A spirit which is not oily in its character would be deficient in lubricating-power, and therefore not so suitable for working the machinery.

Touching the evaporation of spirit to produce power in actual practice, at present the only application which has been successfully developed is for the propulsion of launches. It is termed the "Zephyr" system. For small sizes, certainly there would seem to be no question, that, where the spirit is obtainable, this system is destined to take the place of steam, not so much on account of the probable increased efficiency, as the general convenience of the arrangement. A launch propelled on this plan, 36 feet long by 6 feet beam, and built of steel, has a total weight, including machinery, of only one ton; while, had it been propelled by steam, the weight would have been considerably greater.

Mr. Yarrow did not venture to assign any reason for the apparent gain in the use of spirit over water, but pointed out, that, in a condensing-engine, the two great losses of heat are due, first, to the waste gases which pass up the funnel, and simply go to raise the temperature of the surrounding air; and, second, to the loss arising through raising the temperature of the condensing-water, which goes to warm the sea.

As regards the first loss, it is self-evident, that, owing to the low temperature at which the spirit evaporates, the products of combustion are available to produce evaporation down to a much lower temperature than in the case of water. As an illustration of the low temperature at which the waste gases pass away in the "Zephyr" launches, when going at full speed, it is quite possible to hold one's hand immediately over the funnel.

The results of these experiments give reasonable ground for believing that this system, in some form, is capable of further and possibly extensive development.

WEST INDIAN HURRICANES.

JUNE is the first of the five months that constitute the hurricane season, and every navigator bound for the tropics should now be on his guard, and watch for the earliest indications of an approaching cyclone, lest it may be of hurricane violence. The "Pilot Chart" last month contained a small chart illustrating the general tracks along which these storms move, together with a diagram explaining the importance of the fact that the tracks recurve in a latitude dependent upon the month. In June, for instance, the point of recurvature is in about latitude 20° to 23° north, and here the entire storm moves in a northerly direction, while in lower latitudes it moves north-westerly, and in higher latitudes north-easterly. Each of the accompanying diagrams is therefore applicable to a slightly different belt of latitude, according to the month, as stated therewith. There may be an occasional exception, but a navigator can at first only be guided by the general rule.

A careful study of these diagrams will, it is thought, enable a navigator to form a clear idea as to the general character of West Indian hurricanes. It should, of course, be understood that no two hurricanes are exactly alike; and a master of a vessel can only be guided by what is known from the experience of others, his own experience, and the indications that he can obtain from the weather, wind, barometer, cloud-movements, etc. It is now generally recognized that the old 8-point rule is not always a safe guide for action; and, although the storm-card based upon it has been published on the "Pilot Chart" up to the present time, efforts have been made to explain the spirally inblowing character of the winds in a cyclone. The old storm-card and the 8-point rule can no longer be recommended, except, perhaps, as a rough-and-ready rule for those who will not take advantage of the progress that has been made since this old rule was established. By looking at any one of these diagrams, for instance, it will be seen that the bearing of the centre is hardly ever exactly eight points to the right of the wind, but is generally considerably more than that, especially in rear of the storm. It will be noticed, also, that the storm is never exactly circular, and that its shape changes as it moves along its track. The limited space on the chart forbids any detailed discussion of the subject; but the following brief *résumé*, prepared for the information and guidance of practical navigators during the present hurricane season, is taken from the June "Pilot Chart:"—

The hurricane regions embrace the tropics north of the 10th parallel, the Caribbean Sea, Gulf of Mexico, and a broad belt curving north-westward from about St. Thomas, and following the Gulf Stream toward the Grand Banks of Newfoundland.

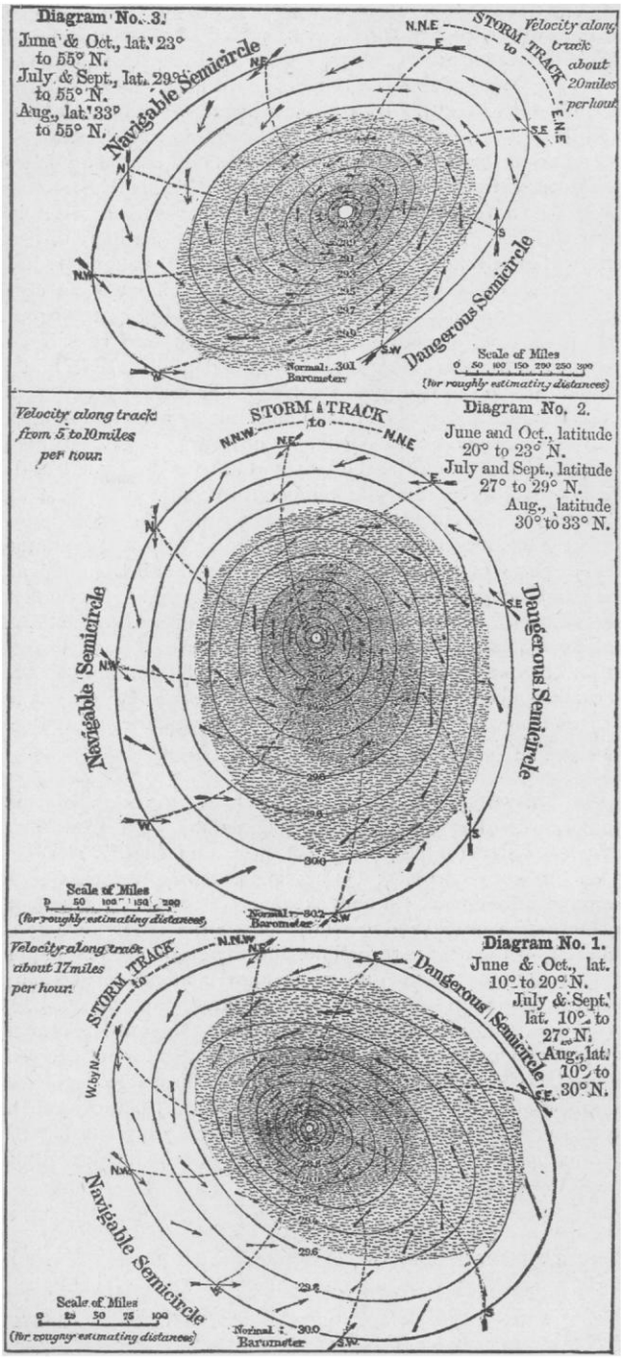
The earliest indications are, unusually high barometer, with cool, dry, fresh winds, and very transparent atmosphere; a long, low ocean-swell from the direction of the distant storm; light, feathery plumes of cirrus clouds, radiating from a point on the horizon where a whitish arc indicates the bearing of the centre.

Unmistakable signs of a hurricane are the following: As the cirrus veil spreads overhead, with halos about the sun and moon, the barometer begins to fall, slowly but steadily, and the ocean-swell increases; the air becomes heavy, hot, and moist; dark red and violet tints are seen at dawn and twilight; the heavy cloud-bank of the hurricane soon appears on the horizon, like a distant mountain range; the barometer falls more rapidly, and the wind freshens, with occasional squalls of fine, misty rain.

As to general size and velocity of progression, the storm area is smaller in the tropics than farther north, the cloud-ring averaging about 500 miles in diameter, and the region of stormy winds 300 miles or even less. In low latitudes the entire storm moves westward and north-westward about 17 miles an hour; in middle latitudes, north-westward and northward, moving more slowly as it recurves; and finally north-eastward, with a velocity of translation of 20 or even 30 miles an hour, its area increasing rapidly as it follows the Gulf Stream toward the Grand Banks, and sweeps across the Atlantic toward northern Europe.

One of the most important indications that an approaching storm is of hurricane violence is the marked cyclonic circulation of the wind, lower and upper clouds, etc. This may be easily appreciated by remembering that a cyclone of any great intensity is an ascending spiral whirl, with a rotary motion (in the northern hemisphere) against the hands of a watch, as shown on the diagrams. The surface wind, therefore, blows spirally inward (*not* circularly, except very near the centre); the next upper current (carrying the low scud and rain clouds), in almost an exact circle about the centre; the next higher current (the high cumulus), in an outward spiral; and so on, up to the highest cirrus clouds, which radiate directly outward. The angle of divergence between the successive currents is almost exactly two points of the compass. Ordinarily, with a surface wind from the north, for instance, the low clouds come from the north also; on the edge of a hurricane, however, they come from north-north-east invariably. In rear of a hurricane, the wind blows still more nearly inward. With a south-east wind, for instance, the centre will bear about west, the low clouds coming from south-south-east (two points to the right of the wind), etc. Great activity of movement of the upper clouds, while the storm is still distant, indicates that the hurricane is of great violence.

Another very important fact (established by Meldrum at Mauritius) may be stated thus: When a hurricane is moving along the equatorial limits of a trade-wind region, there is a belt of intensified trades to windward of its track. Not until the barometer has fallen about six-tenths of an inch is it safe to assume, that, because the trade-wind increases in force and remains steady in



The small arrows fly with the wind, and the dotted lines (radiating from the centre) join points having same wind-direction (stated at outer arrow). The ovals are isobars, the barometer falling .20 of an inch from one curve to the next inner one. The shaded area is the region where it is most dangerous for a vessel. The average size of one of these storms in different latitudes can be estimated by means of the scale of miles accompanying each diagram.

direction, you are on the track of the storm. By attempting too early to cross its track, running free as soon as the wind begins to freshen, you are liable to plunge directly into the vortex of the hurricane.

Brief rules for action are the following: Watch carefully for the earliest indications, recording observations of barometer, thermometers, wind and weather, for future reference. When there is good reason to suspect that a hurricane is approaching, consider the latitude you are in, and the month, with a view to decide the probable direction in which the storm is moving, and when its track is likely to recurve. Early action may thus be taken to avoid its path. When the decided fall of the barometer, freshening rain-squalls, and other unmistakable signs, indicate that the cyclone is close upon you, observe the shifts of wind very carefully, in order to determine whether you are to the right or left of the storm-track. Remember that it is sometimes best to lie to when thus observing the shifts of wind. A fast steamer, for instance, may run into the dangerous semicircle of a slow-moving cyclone, and yet get shifts of wind characteristic of the navigable semicircle. If the freshening gale remain steady in direction, you are on the track of the advancing storm: square away, at all hazards, and run with the wind on the starboard quarter, keeping your compass course as the wind shifts; if obliged to lie to, do so on the port tack. If the wind shift to the right, you are to the right of the storm-track: put the ship on the starboard tack, and make as much headway as possible; if obliged to lie to, do so on the starboard tack. If the wind shift to the left, you are to the left of the storm-track: bring the wind on the starboard quarter, and keep your compass course, if possible; if obliged to lie to, do so on the port tack. Any attempt to cross the storm-track is dangerous; but, if you decide that it must be attempted, crowd sail and keep the wind well on the starboard quarter. In scudding, always keep the wind well on the starboard quarter, in order to run out of the storm. If obliged to lie to, always do so on the coming-up tack, so that the wind will shift aft, and not take you aback. Should you get into the central calm of a tropical cyclone, look out for a terrific squall from a point of the compass almost exactly opposite to that from which the wind was blowing when it fell calm.

So long as the barometer continues to fall, the centre is getting nearer. When it steadies and begins to rise, this marks the nearest point; and here the shifts of wind will be most sudden and violent, and the sea highest and most confused. If, when lying to, the wind begins to shift in the opposite direction to what it did at first, it is evidence that the storm-track is recurving, and your semicircle is changed: immediate action must be taken to suit the new conditions. But if your vessel is making any great headway, it may give you a shift of wind contrary to what you would have if lying to: this must be always borne in mind. Cool weather is characteristic, in extra-tropical regions, of the navigable semicircle, owing to the indraught from the north-westward; warm weather, on the contrary, indicates the dangerous semicircle, where the air is drawn in from the south-eastward.

After encountering a hurricane in the tropics, a northward-bound vessel is very liable to encounter the same storm again in higher latitudes, after it has recurved. The navigator should therefore remember that there is a hurricane off to the westward, and look out for it as he goes north.

There are two cyclone currents to be considered, — a current moving in a circular direction around the centre, caused by the wind; and a current which follows the storm along its track. These vary considerably with different storms, but should always be taken into account when near the coast.

The testimony as to the great value of the use of oil in heavy seas is so conclusive that it is now recognized by every commercial nation. No ship can afford to neglect its use in an emergency, when heavy broken seas threaten to come on board. Once tried, its value will never be disputed. Fifty-four reports have already been received this year from masters of vessels who have used oil with great success: thirteen of these refer to a single storm, the hurricane off Hatteras, April 6–9, and new reports are received almost every day.

ELECTRICAL NEWS.

The Average Efficiency of Incandescent Lamps.

AT the meeting of the Institute of Electrical Engineers, held on May 22, Mr. W. H. Peirce read a paper under the title "Relation between the Initial and Average Efficiency of Incandescent Electric Lamps," which gave the results of experiments made by him for the Chicago, Burlington, and Quincy Railroad. Four

makes of lamps were used in the tests, their candle-power and efficiency being determined at intervals during a working period of 850 hours. There were fifteen commercial lamps of each make at first, but afterwards some additional lamps were sent from the factories. The methods of tests used were calculated to give accurate results, and much care was taken in the measurements, there being frequent comparisons of both current and potential measuring-instruments with standards; while the Methuen burner used in determining the candle-power was compared with standard candles, and found to be practically correct.

The results of the measurements can hardly be regarded as flattering to incandescent-lamp manufactures. The initial efficiency of the lamps varied from about 3 watts to the candle-power (about fifteen 16-candle-power lamps to the electrical horse-power) to 5 watts to the candle-power (nine lamps to the horse-power). As time went on, however, the lamps, from the blackening of the globes and the increased resistance of the filaments, grew dimmer, until the candle-power had gone down in some cases to six or eight candles; while the efficiency had decreased, until in some cases lamps which gave a candle-light with an expenditure of 3 watts, finally required 7 watts to give the same light. The highest average efficiency for any make of lamps, for 800 hours, was 4.58 watts, the lowest 5.8 watts, per candle-power. Probably the most satisfactory of the lamps experimented on had an average efficiency of about 4.8 watts; the final candle-power, after 900 hours' service, being about 14, the initial being 16 candles.

An important point brought out in these tests is the marked decrease in the candle-power of commercial lamps, even after a moderate service. It is not at all satisfactory to consumers to have the lamp gradually decrease in brightness until it finally does not give enough light to read by, and to this cause may doubtless be attributed the comparatively slow introduction of the light. If the users are to replace the lamps, it is hardly in human nature to do so until they are broken, and a life of 2,000 or 3,000 hours is not uncommon. At the end of that time, a 16-candle lamp is giving about six candles, and that at a very low efficiency. There are many electric-light companies that guarantee twelve 16-candle lamps to the mechanical horse-power (equivalent to an efficiency of the lamp of about 3 watts to the candle). It is possible that a plant might give such results for a few hours; but, if these tests are to be trusted, none of the lamps in extended commercial use can do better than a candle-power for 4.8 watts, with the light at the end of 900 hours having 85 per cent of its initial brilliancy. The practical life of the lamp, then, is limited by two things, — the breaking of the filament, and the decrease of candle-power. This latter has not been recognized as it should have been, and Mr. Peirce's paper is of value in calling attention to it.

INHERENT DEFECTS OF LEAD SECONDARY BATTERIES. — A paper under this title was read at the meeting of the Institute of Electrical Engineers by Dr. Louis Duncan. It consisted mainly of a description of and deductions from a series of experiments which had been carried on by himself and Mr. Henry Wiegand during the past year; the principal points investigated being the loss of energy in charging and discharging such cells, with the causes of their deterioration. The cells experimented on were of the "grid" type, in which the active materials — peroxide of lead and spongy lead — are pasted into hourglass-shaped cavities in a cast-lead "grid." This type is the one almost universally used in commercial work, and it has so far been the most successful. The defects of these batteries lie (1) in the limited storage capacity, it being but one-eighth of the calculated value; (2) in the loss of energy in charge and discharge; (3) in the deterioration; (4) in the low discharge rate allowed by considerations of efficiency and length of life. The loss of energy exhibits itself by two effects, — a lower potential difference on discharge than on charge, and a loss in ampère hours between charge and discharge. The loss of energy must be traced to two things, — the production of heat or the formation of irreversible chemical products. It is known that the electro-motive force of a secondary battery is greater as the strength of the acid increases. When the strength is greatly diminished, there is a formation of irreversible sulphates of lead and a rapid corrosion of the plates. It is also known that discharge of the cell consists in a sulphating of both plates, causing a weakening of the acid; charge results in desulphating, strengthening the acid. In the plugs of active material, where diffusion is slow, there must be considerable differences of density in the acid between charge and discharge, this being especially the case when the current rate is considerable. We can consider, then, that the charge is in strong acid; the discharge, in weak. To these considerations correspond the facts that the electro-motive force is higher on charge than discharge; that a rapid discharge lowers the electro-motive force, which, however, rises again after a period of repose; and that a rapid discharge causes a deterioration of the plates. To see if there were any ground for these suppositions, experiments were made on the rate of diffusion of acid from the plates, and it was found to be slow, especially with partly run-down plates, this corresponding to the fact that fully charged plates can be discharged more rapidly than partly discharged ones. To fix the losses of energy which result in heat effects, a cell was discharged in a calorimeter, and the rise of temperature and other data observed under various circumstances. The first thing that appeared was, that there was a much greater heating during charge than during discharge, there being sometimes an absolute fall of temperature in the latter case, when the C^2R effect was allowed for. This is partly due to the weakening and strengthening of the acid in the solution, there being of course a corresponding absorption or production of heat. Every one who has mixed acid and water is aware of the latter fact. Again, on charging or discharging for short periods, allowing the cell to stand idle for the same length of time, it was observed that the temperature continued to rise after the current had stopped. This was accounted for by supposing, that, the distribution of current in the plugs not being uniform, different parts of the same plug would be in different chemical states, and local currents would be produced, tending to make the plug uniform. These local currents cause losses, which exhibit themselves finally as heat. The principal cause of loss, however, seems to be due to the electrolysis of the solution, the loss from this cause appearing as heat, and in the liberation of oxygen and hydrogen from the two plates. The other losses are mainly due to the formation of irreversible products in the form of lead salts. In one discharge and charge cited, the total loss was 98 watt hours. Of these, 51 watts were accounted for in heat; the remainder must have been due to irreversible chemical actions. The heat losses may be classed as (1) the Joule effect, measured by C^2R; (2) heating due to eddy-currents; (3) heating due to electrolysis of the solution into free hydrogen and oxygen. It should be noted that the alternate heating and cooling due to the strengthening and weakening of the acid is reversible, and therefore does not appear as a loss. Of the losses due to chemical actions during charge, which are not reversed on discharge, the most important, as far as loss of energy goes, is the electrolysis of the solution into free hydrogen and oxygen. The most important, so far as deterioration goes, is the formation of salts of lead on discharge in the weak acid in the plug, from the material of the support-plate. This last effect is exaggerated by rapid discharge, or by discharging until the formation of the more bulky sulphate of lead has greatly decreased the diffusion.

HEALTH MATTERS.

WOMEN'S BREATHING. — Our readers will doubtless remember the claim made by Dr. Thomas J. Mays of Philadelphia, that he had succeeded in demonstrating that the statement made in almost every text-book on physiology, that it was natural for women to breathe from the chest, was wrong; that the abdominal type of respiration, as ordinarily observed in men, was the natural type of women as well, and the costal type as seen in women is the result of modern dress. This claim he supported by the result of an examination of eighty-two American Indian girls. Dr. J. H. Kellogg, from an examination of Chinese and other women untrammelled by tight-fitting dress, finds the abdominal type present in them. Other observers, notably Hutchinson, in twenty-four girls whose waists had never been constricted by corsets or other appliances, found the costal type present. The question of what is the natural type of respiration may therefore still be regarded as *sub judice*, unless, which perhaps may be the truth, both types are natural under varying conditions, independent of dress.

FILTERS. — Dr. Currier of New York has recently been engaged in examining into the efficacy of filters and other means employed to purify drinking-water. His paper on the subject is published in the *Medical News*. He summarizes the result of the investigation as follows: Boiling sterilizes water, and within thirty minutes will have killed harmful bacteria. Drugs and other agents acting chemically, if used in amounts which are commonly safe, do not sterilize water. The prolonged heat which water undergoes in the usual process of distillation destroys all germs which may be in the water undergoing the process. Ordinary filters, even if satisfactory as strainers, fail to remove all bacteria from drinking-water. So far from lessening the number in the original water, the filtering substance may allow a more rapid multiplication than these micro-organisms would ordinarily undergo in the unfiltered water on standing; and the germs of disease, even if held back by the filtering substance, may be harbored in all filters. The finer the substance through which the water passes, and the lower the pressure, the more perfect is the action of the filter in holding back the bacteria. Of all substances thus far furnished for domestic filters, porous rebaked porcelain, carefully selected, has been found to be the best. If thick and strong enough to allow the use of a large surface, and the substance remain perfect (without flaw or break), this may yield a fair flow of clear water, free from all bacteria; yet, under our ordinary Croton pressure of one atmosphere or less, this yield is only in rapid drops, unless the apparatus be complex. To insure the permanency of this action, the filter should be occasionally sterilized throughout, by steaming or by other means; for, under prolonged pressure, various kinds of bacteria can go through, and in the copious organic matter collected on the filter some harmful micro-organisms can retain a high degree of vitality for weeks longer than they have ever been found to live in pure water. Where filtering is really necessary, it is in general best for the community that it be done carefully on a large scale through sand-beds upon which a fine layer of organic and inorganic matter is expressly produced by sedimentation, because of its valuable action in holding back the great majority of the bacteria. A bad water filtered is less desirable than a pure water in its natural state. When, therefore, filtration is employed because of real danger of infection, the filtered water should, as a rule, be furthermore boiled, as the entire absence of sediment and cloudiness does not insure that the bacteria of disease may not have made their way through the filter.

ASPHYXIATION BY ILLUMINATING-GAS. — At a recent meeting of the American Gaslight Association of Toronto, the following rules were given, to be followed when men are overcome by gas: 1. Take the man at once into fresh air. Don't crowd around him. 2. Keep him on his back. Don't raise his head nor turn him on his side. 3. Loosen his clothing at his neck and waist. 4. Give a little brandy and water, — not more than four tablespoonfuls of brandy in all. Give the ammonia mixture (one part aromatic ammonia to sixteen parts water) in small quantities, at short intervals, — a teaspoonful every two or three minutes. 5. Slap the face and chest with the wet end of a towel. 6. Apply warmth and friction if the body and limbs are cold. 7. If the breathing is feeble or irregular, artificial respiration should be used, and kept up until there is no doubt that it can no longer be of use. 8. Administer oxygen.

CANCER CONTAGION. — The contagiousness of cancer is still a mooted question. Dr. Arnaudet, in *La Normandie Médicale*, maintains the affirmative of the question, and gives the following facts to support his views: At Saint-Sylvestre-de-Cormeilles, which has a population of about four hundred persons, there were seventy-four deaths in eight years. Of these, eleven were from cancer. In the neighboring villages of Normandy, although exact figures are wanting, the death-rate from cancer is said to be nearly the same. Of these eleven cases, six occurred within a limited area, and the order of their occurrence was such as to suggest a possible connection between them. The first case was that of a man living in an elevated portion of the hamlet; the next case was a man living on the side of the hill below the first; then three cases occurred almost simultaneously in persons living close together in the valley at the foot of this hill; and the sixth patient was a near neighbor of the first, on the plateau above the valley. In none of these cases could any history of heredity be obtained, and they were all free from the reproach of alcoholic addiction. In five of the cases the cancer was seated in the stomach, and in the sixth the location of the disease was in the neck. Dr. Arnaudet believed that the germ of the disease, microbial in its nature, was carried in the water. None of the patients drank water, but they were all moderate consumers of cider, and that was the beverage that the author accused of being the carrier of the contagion. In making cider, the inhabitants of that region added water taken from the swampy ground; and the darker the color of the water, consequently the more impure, the higher it was esteemed as a diluent of the apple-juice.

NOTES AND NEWS.

THE invention and development of electric welding of solid bodies by Professor Elihu Thomson has been followed by a method of making endless pipes by the adaptation of the discovery to that purpose. This has apparently been done by Mr. Elias E. Ries of Baltimore. The smooth interior of the pipe is secured by the use of a removable refractory core, made of some insulating material, or the same object is attained by subjecting the interior of the pipe while being welded to compressed air or fluid pressure.

— In a description of the Calais harbor works in *Engineering*, occurs the following reference to the use of the water-jet for sinking the piles of the protecting dike or dam of the sluicing-basin: "The engineer in charge of this portion of the work sunk all the piles with the help of water-jets, — a system which has, of course, been in use for many years for sinking cylinders and iron piles, but which, we believe, had never been previously employed in this particular manner. The first trials were made in 1877, and the results obtained were so remarkable that the method was followed throughout nearly the whole of the work. Before this means was tried, the operation of driving a panel of sheet piling 9 feet high and 6 feet wide required 900 blows from a 1,300-pound weight, and the average time occupied was 8½ hours. The sand offered so much resistance, that the thickness of the piling had to be increased from 3-inch to 5-inch, and even then the wood was frequently broken. All these difficulties disappeared with the introduction of the water-jet, which was forced into the sand by hand-pumps through a 1-inch nozzle connected to rubber tubes. Much wider panels could be lowered in this manner, and the time of sinking was reduced to about one hour, while in many cases the operation was completed in 15 minutes. The number of blows from the falling weight never exceeded 50, and were only necessary to overcome the friction between the adjoining panels, which were tongued and grooved so as to make a tight joint. As a rule, the weight of the 1,300-pound tup resting on the head of a 10-foot pile sufficed to drive it almost instantly into its place."

— An international congress of agriculture and forestry will be held in Vienna during the summer of 1890.

— We learn from the *American Lancet* that since its establishment the Minnesota Board of Medical Examiners have had eighty-six applications for examination for a license to practise medicine. Of these, six were refused admission because they had not taken three full courses of lectures of six months each. Of the eighty entering the examination, fifty-one were found able to pass the same, and twenty-nine were rejected as not possessing the knowledge of medicine required by the board. Of those passing, forty-nine are regular, and two are homœopathic. Of those rejected, eighteen were regulars, eight homœopaths, and three eclectics. Students from two-term medical colleges cannot even get a chance to be examined in Minnesota.

— An improved method of producing phosphorus has lately been patented in Paris. It consists, as described in *The Engineering and Mining Journal*, in treating bones or powdered mineral with nitric acid. A large proportion of the calcium is then removed from the solution — on the addition of potassium sulphate to liquid — in the form of calcium sulphate. The liquid then contains phosphoric acid and potassium and calcium nitrates. After removing the precipitated calcium sulphate by means of filtration, sufficient mercurious nitrate is added to precipitate the phosphoric acid as mercury phosphate. The phosphate of mercury so ob-

tained is collected and dried, and afterwards distilled with carbon, when mercury and then phosphorus are distilled over. The mercury may be reconverted into nitrate to serve as a second charge; and the liquors, after removing the mercury phosphate, yield, on adding more potassium sulphate, a solution from which potassium nitrate can be crystallized.

— According to the Rome correspondent of the London *Daily News*, the Pope has decreed, owing to the wishes expressed by Padre Denza more than a year ago, that the works for the Astronomical Observatory, to be erected in the Vatican, are to be begun at once. The site selected is the tower over the rooms occupied by the master of the Sacred College, it being the most elevated building of the Vatican Palace. The cost is estimated at a million of francs.

— It is reported in the Chinese press that the Marquis Tsêng, so well known in Europe as the ambassador of China to this country, has been appointed to the control of the Foreign Science College in Peking.

— The Botanical Gardens at Edinburgh are now for the first time opened to the public on Sundays.

— Dr. John Gibson, who has for some time been engaged in superintending the physical work of the Fishery Board for Scotland, has recently completed a series of investigations which are likely to throw considerable light on the problems connected with ocean-currents. The detailed results will appear in the next annual report of the Fishery Board; but, from a preliminary note communicated to the Royal Society of Edinburgh, *Nature* states that it appears that two chemically distinct kinds of sea-water are present in the North Sea. The difference between these two waters is rendered perfectly distinct by sufficiently accurate determinations of the relation between chlorine and density, and is not due to river-water flowing into the North Sea. Water in which the relative proportion of chlorine is high reaches the North Sea from the surface of the Atlantic, round the north of Scotland and also through the English Channel, while water in which the relative proportion of chlorine is low flows into the North Sea from the north, and has been found on the surface as far north as 79° north latitude. The determinations of chlorine and density in the samples of ocean-water collected during the "Challenger" expedition, as published in the "Challenger" reports, seem to show that similar differences of composition exist in ocean-waters. To judge from these determinations, the mass of ocean-water, especially in southern latitudes, approximates in chemical composition to that flowing, as above mentioned, into the North Sea from the surface of the Atlantic. The water in which the relative proportion of chlorine is less appears to have been met with chiefly to the north of the equator and to the south-west of the principal outlets from the Arctic Ocean. This, as well as its chemical composition, seems to point to an Arctic origin.

— A catalogue of minerals and synonymes alphabetically arranged for the use of museums, by T. Egleston, Ph.D., has been published as Bulletin No. 33 of the United States National Museum. This catalogue was commenced in the year 1867, for use in arranging the collections of the School of Mines of Columbia College; but after many months' labor, when the work was nearly completed up to that date, it was abandoned on account of the press of other duties. In the last year, however, having occasion to make some investigations, and finding it almost impossible to get at the different synonymes of the various minerals on account of the imperfections of the indices of the various works, the work was taken up again and finished. It was found that the progress of the science since 1867 had been so great that the work previously done had to be altogether abandoned, so that all that is left of it is the general plan. It is hardly to be hoped that this catalogue is without errors, or that every name which has been published has been found. There are, however, several thousand more names contained in it than in any other published index.

— In 1885, after peace had been declared between France and China, the viceroy, Li Hung Chang, obtained the imperial sanction for opening military and naval schools at Tien-Tsin, where Chinese pupils could receive instruction in Western sciences. Consul Smithers of Tien-Tsin says that the military school has been in operation five years, and has 150 pupils. It has four German professors, and the instruction is entirely in the German and Chinese languages. The naval school is divided into two departments, — the executive, for the training of naval officers; and the engineering, for the training of engineers. The number of pupils is 120, selected from the different provinces of the empire, and the length of the course is five years. The director of studies is assisted by three English professors, two of whom belong to the English Navy. The director himself, Yen Tsung Kwang, is a graduate of the foreign school at Foochow, and has served in the navy. A school for instruction in telegraphy was organized in 1880, and at present has forty-eight pupils. The instructors in this school are Danes, but the instruction is given in the English language. A local medical school, with a hospital attached, was founded some years ago by the viceroy. This school is now about to be re-organized, with an eminent foreign doctor at its head, the object being to qualify young men for the medical profession, and attach them to the army and navy as well as other branches of the public service. In addition to the schools already mentioned, Consul Smithers, writing under date of the 31st of December last, says that an Anglo-Chinese college was to be opened early in 1889. The building for this college was commenced in 1887. It is a fine Gothic structure situated on the left bank of the Peiho, and has accommodations for 300 students. In conclusion, the United States consul says, "When it is considered that hitherto the officers in the Chinese army and navy below the rank of general and admiral have been taken from the uneducated classes, and have obtained their commissions often by purchase, and that both branches of the service have been without a medical staff, the importance of the educational establishments at Tien-Tsin, promoted and fostered by the viceroy, cannot be overestimated."

— In an article on the Strong locomotive, in the May number of the *Engineering Journal*, it was stated that the run which the Strong engine made from Jersey City to Buffalo on the Erie Railroad was the longest continuous run of which we have any record, with the exception of a trip from Jersey City to Pittsburgh on the Pennsylvania Railroad some years ago. This statement, which was made from memory and without investigating the records, was, it appears, erroneous, and is corrected in the June issue. The train, which was famous at the time as the "Jarrett and Palmer Fast Train," and which ran from Jersey City to San Francisco in 84 hours, was drawn over the Central Pacific Railroad from Ogden to Oakland, 879 miles, by a single locomotive, which, like the Strong locomotive, made stops at several points. The greatest speed attained at any point on the journey was 60 miles an hour; the average speed for the whole distance, 36.8 miles an hour. The engine which made this very unusual run was an ordinary eight-wheel engine, No. 149, built by the Schenectady Locomotive Works, having 16 by 24 inch cylinders and 5-foot drivers. Only the necessary stops were made, and the full time was 23 hours, 59 minutes. As before noted, while neither this run nor the run of the Strong locomotive were continuous in a certain sense, both of the engines having made stops at several points, the run made from Jersey City to Pittsburgh on the Pennsylvania Railroad was really continuous, the engine having gone over the entire distance without stopping, water being taken up from the track-tanks on the way. This, of course, does not detract from the work done by the Strong engine: it only shows that such runs can be made on occasion; but their rarity goes to prove that the making them is too much for the ordinary locomotive.

— The United States steamship "Yantic," Commander C. H. Rockwell, U.S.N., commanding, sailed from New York, May 11, on a cruise off the coast to destroy derelict vessels, information regarding which was supplied by the United States Hydrographic Office. May 18, in latitude 37° 35′ north, longitude 69° 55′ west, she sighted the water-logged schooner "Alice Borda," of Camden, N.J., with deck-houses, hatches, and mizzenmast gone, mainmast out of step and leaning forward. Torpedoes were exploded astern, under the bilge on each side, under the heel of the bowsprit, and inside the port quarter, breaking her up very well. She was then set on fire, and, it is supposed, went down on the night of the

19th, although it was very difficult to destroy her, being lumber-laden. Unfortunately the "Yantic" encountered a hurricane of great violence the afternoon of the 21st, by which she was dismasted and compelled to give up her cruise and return to New York.

— Erastus Wiman, in a letter to the editor of the *Railroad Gazette*, states that the use of mica, ground by the cyclone pulverizer, as a lubricant, is assuming very great importance in connection with railways. The managers of a cyclone plant, which has been erected at Denver for the New Mexico Mica Mining Company, have ground mica to such an excessive fineness that the tests of the material as a lubricant have been very successful. A letter just received from Denver states that on the Rock Island Road the mica experiment was very satisfactory. They cooled off journals that came in heated, by applying mica, and the agent reports that one which came in very hot was sent forward as soon as the mica lubricant had been applied. The train despatcher received reports from different stations on the road, that it had cooled off, and was running all right. The experiments that have been made with mica lubricant and mica dope have been successful. The one was made with crude oil and mica, and the other with mica and the residuum from the wells, being a very much cheaper grade of oil. The officials of the Union Pacific and of the Denver and Fort Worth Roads have applied for the privilege of a test. It will be curious if this singular mineral should be found to be a lubricant, to serve so useful a purpose as that of a substitute for that crudest of devices, a huge clot of waste saturated with oil.

— The American steamship "Santiago," Captain Allen, passed through the centre of a water-spout on April 29, latitude 25° 38′ north, longitude 76° 47′ west. The detailed report forwarded by Chief Officer Calloway is one of the best ever received by the United States Hydrographic Office.

—Professor J. Burkitt Webb of Stevens Institute, Hoboken, N.J., is conducting a series of experiments with graphic reproduction processes, there being quite a need of some method whereby he can distribute diagrams and plates on graphical statics of a nature that cannot be set up in type, and yet would not repay the cost of engraving. Notwithstanding all the efforts of inventors, this problem does not seem to be solved, as the processes in vogue either yield poor results or involve much labor or cost.

—Recent analyses of commercial fertilizers and manurial substances sent to the Massachusetts State Agricultural Experiment Station for examination show that both cottonseed-meal and linseed-meal must be counted among our cheapest concentrated fodder ingredients, on account of the high commercial value of the fertilizing constituents they contain, varying from $22.70 to $25 per ton in the former, and from $21.76 to $24.04 in the latter. The samples of linseed-meal differed somewhat in their mechanical condition, which may be merely incidental. Their variation in composition, if obtained from the same lot of seed, is mainly due to the particular mode used to secure the oil of the seed. The old process consists in the use of a powerful press; the new process, in the abstraction of the oil by means of benzine or bisulphide of carbon. The latter mode of treatment aims, for enonomical reasons, at a more complete abstraction of the oil than the press can accomplish. To this circumstance it is mainly due that, as a rule, the meal obtained by the use of the old process contains in the same quantity more oil and less nitrogen containing organic constituents than that obtained by the new process.

— William Wallace, the chimney-repairer, is never out of work. He sets up his own peculiar device for staging, which enables him to complete a job in about the time that it takes to erect an ordinary staging. "Steeple Jack," as he is called, first places a long light ladder against the chimney that is to be operated on. Then, mounting it, he drives a peculiarly shaped iron pin into the brickwork, and binds the top of the ladder fast to this pin. Standing on the top round of this ladder, he drives another pin into the chimney as high above his head as he can reach. A rope is then passed over this pin, and made fast to a round in a second ladder about three feet from its bottom round. This ladder is then hoisted up until it rests on top of the first ladder. It is then made fast to the lower pin; and then "Steeple Jack" mounts to the top of it, and, driving in another pin, secures the top round to that. From this ladder a third is hoisted as before; and Jack and the ladders, as many of them as may be necessary, continue to rise as far as may be desired. It is estimated that he has climbed about fifteen miles up into the air in this way. The only accident he ever met with was at Mansfield, Mass., when he fell from a chimney with a ladder. He landed in a tree, however, and escaped injury. His set of ladders is his only staging, and he can mount a 180-foot chimney in three hours. He raises his own brick and mortar by standing on top of the chimney and pulling them up. He learned his trade with the original "Steeple Jack Davis," in England, and has travelled extensively through Europe with his ladders, besides working in most of the large cities in this country.

— The Astley-Cooper prize, of a value of $1,500, will be awarded in 1892. The question proposed is "The Influence of Micro-organisms upon Inflammation." The papers of those contesting for the prize should be written in English or accompanied by an English translation, and should be addressed before the 1st of January, 1892, to the Guy Hospital, London. The prize will not be awarded to two or three working together.

— The ship "Hvidjörnen" arrived at Copenhagen on May 21 from Greenland, having on board Dr. Fridtjof Nansen and his companions, who succeeded in crossing Greenland from east to west on snow-shoes. The members of the expedition received an enthusiastic welcome from a large crowd. Dr. Nansen has made further report of the experiences of his party in their journey across the Greenland ice. Before they got a landing on the east coast, they drifted for twelve days in the ice in the boats in which they had been left by a Norwegian sealer. They strove hard to reach the shore, but thrice, when on the point of succeeding, were carried out again to sea. For a whole day and night they expected to perish in the tremendous breakers of the sea against the ice rim. Dr. Nansen's account of his adventures, as it appears in the London *Daily News*, contains the following: "After two days, near the dreaded glacier of Puisortok, we met a native camp of about seventy men, part of whom were bound for the north. We were glad of the meeting, and counted on valuable help from their knowledge of the currents on the coast. We were, however, disappointed, for, instead of taking the lead, they let us break the ice, and contented themselves with following in our wake. Some days after, having reached latitude 63¼°, some other natives who saw us took to flight, thinking us supernatural beings, though we made signs that we wished to be good friends. We took no brandy. At first it was warm in the daytime, and we walked at night; later we reversed the proceeding. At first there were plenty of wide crevices, and we had to be constantly on the alert to prevent an accident. On the third day a downpour of rain commenced, which kept us in our tent for three days. When we proceeded, no drinking-water was to be had: we were forced to melt the snow for cooking purposes and for our tin bottles. When we had altered our course, we got a side wind, and rigged masts and sails on the sledges, made of the tent flooring and tarpaulins. The wind abating, we had to give up sailing, and used our snow-shoes and skates. The drifting snow hampered our progress, but the surface was still even like a floor, and the ground still rose, till, at the beginning of September, we had climbed to a height of 9,000 feet. We were now on an extensive plateau like a frozen sea. We were more than two weeks passing over it. The cold was most severe, the thermometer falling below the scale, and, as I calculate, no less than 50° below zero Centigrade. One morning I found that in the thermometer under my pillow the spirit had receded below 40° into the ball. On Sept. 7 a severe snow-storm nearly overturned our tent, and on the next day we were overtaken by an awful drift. The tent was completely buried, and we had to dig it out. On the 19th there was again a favorable wind, and we lashed the sledges together, and, as we used the sails, it was unnecessary to pull. We held on to the sledges, standing on our snow-shoes as we rattled down the slope at a splendid rate. It was the pleasantest skating I ever had in my life. The same afternoon we sighted the first hilltop on the western coast. It was already dusk when we noticed a dark object ahead, and, rushing on, we discovered a fearful

crevice, which brought us to a sudden stop. It was high time: we were already on the very edge, and in two seconds more we should have been swallowed up in the bottomless abyss. We came across several more, and, in spite of the greatest care, we had other hair-breadth escapes. Once we were within an ace of destruction through a snow-bridge falling."

— The *Journal de la Chambre de Commerce de Constantinople* says that the cultivation of the red-pepper plant occupies a very important place among the several branches of cultivation practised in Turkey. This cultivation is chiefly making progress in the cantons of Karadja Abad, in the districts of Vardar Yenidje and of Védine, vilayet of Salonica. Formerly the production of red pepper was unimportant, for it was limited to the requirements of local consumption in the vilayet; but, since foreign countries have bought these peppers, cultivation has rapidly extended. The plant itself prefers a sandy and humid soil, where it grows sometimes almost in the water. It is estimated that the plant produces from 120 to 400 okes (oke = 2.84 pounds) of pepper per deunum (deunum = 40 square paces), according to quality. On an average, the expenses do not exceed 300 gold piastres for the cultivation of each deunum; and an oke of this pepper costs from 30 paras up to 5½ piastres, according to quality. The profit realized on the average is from 300 to 350 piastres per deunum. Harvesting only commences when the plants are entirely red. The produce of the first gathering is of superior quality; but that of the last is bad, as the pepper-plant reddens imperfectly in the autumn. This year the yield of red pepper has reached, in the canton of Yenidje Karadja Abad, the figure of 350,000 okes, and in that of Védine Karadja Abad, about the same amount. Of this yield, 45 per cent is exported to Europe; 30 per cent to Bulgaria, Servia, and Austria-Hungary; the remainder being sent to different parts of the Turkish Empire.

— The seed-trade appears to be destined to a very great expansion in California at a not very distant period. In the single county of Santa Clara, not less than 1,200 acres are now devoted to the production of garden-seeds. Over 60,000 pounds of lettuce-seed, and 120,000 pounds of onion-seed, have been shipped east from these grounds in a single season. In other counties a quite important business has been developed in the production of clover-seed, beans, and peas, for the supply of distant markets. While that State may not secure the monopoly of the seed-business, because good seeds are grown in the Atlantic States, the rapid increase of business in California indicates that one, at least, of the great centres of the seed-business, is to be in that State. The quality of many small seeds produced there, such as onion and lettuce, will have much to do in bringing the seed interest into greater prominence.

— The June *Magazine of American History*, with which its twenty-first volume is completed, opens with a sketch of "The Historic Capital of Iowa," now the seat of the State University, written by Mrs. Eva Emery Dye of Iowa City. The second contribution is an account of "The Ancient and Honorable Artillery Company of Massachusetts," by C. E. S. Rasay, M.A., the romantic story beginning with the first settlers of New England, and closing with the recent interchange of civilities between the Ancient and Honorable London and American Artillery Companies, the two oldest military organizations in the world. Following these, Georgia divides the honors of the number with Iowa and Massachusetts in an able article by T. K. Oglesby, on "Georgia and the Constitution." "The Last Twelve Days of Major John André," by Hon. J. O. Dykman, unfolds a suggestive field of study, and is to be continued through two future issues of the magazine. "A Boston Writing School before the Revolution," by William C. Bates, gives a picturesque picture of men and scenes in that early period. No feature of the June number, however, will be likely to attract more attention than the "Evolution of the Constitution," by C. Oscar Beasley. "The Study of the Mental Life of Nations," by Franklin A. Beecher; a hymn, "The Washington Centennial," by J. R. Barnes; "A Hundred Years to Come," by an unknown author; and three letters of Hon. Roger Griswold to his wife, contributed by Mrs. J. Osborne Moss, — may be noted.

— Since salicylic acid has been prohibited for the preservation of drinks and foods, some brewers have undertaken to use benzoic acid for the preservation of beers. In doses of five to six grams to the hectolitre, benzoic acid, if not especially poisonous, is at least active in preventing to a noticeable extent the assimilation of the albuminoids, and in modifying the mucous secretions. From this result digestive troubles in those persons who continue to use it for any length of time. Notwithstanding the small amount used industrially, it is probable that this use should be prohibited, as is that of salicylic acid. All antiseptics interfere with the normal digestive powers of the human system, and consequently with proper nutrition, and it is necessary that their use in the industries should come to an end.

— Professor F. E. Nipher made a verbal report at a meeting of the Engineers' Club of St. Louis, May 15, on a recent investigation into the performance of an engine working at a fixed cut-off without governor. Measuring the brake horse-power, the pressure of the supply-steam, and speed, he finds that the performance of the engine is represented by an hyperbolic paraboloid, in which the lines of constant load and the lines of constant speed are rectilinear elements. At any fixed pressure, the relation between output and speed is represented by a parabola, the vertex of which represents a condition of maximum output. The condition of maximum output at any pressure is, that the moment of the force on the brake-arm must be one-half that moment, M', which will bring the engine to rest, while the speed must be one-half that speed, N', which the engine would have if the load were entirely removed. The maximum output is then in horse-power, $\frac{\frac{1}{2}\pi}{33000} M'N'$. Professor Nipher stated that he should proceed to determine whether mean effective pressure might be substituted for pressure of supply-steam. His present opinion was that it could. In that case, indicated horse-power could be represented as a function of the same coördinates, P and N. The equation for indicated horse-power is $PN = \frac{33000}{\frac{1}{2}\pi R^2 L}$ (indicated horse-power), where R is piston radius, and L is stroke. This is also an equation of the hyperbolic parabola, the axes of which are in an entirely different position from those of the surface of brake horse-power. Both surfaces contain the pressure axis. The difference between the two horse-power ordinates will give the real engine friction for any load and speed. It follows from these equations that the work consumed in the friction of an engine is constant for all loads if the speed is constant.

— Two naturalists, the one a Hollander, and the other a German, — Messrs. Kannegieter and Fruhstörfer, — have just started on a zoölogical exploration to Borneo, Java, and Sumatra.

— At the meeting of the Royal Meteorological Society, London, May 15, Mr. W. H. Dines gave an account of some experiments made to investigate the connection between the pressure and velocity of the wind. These experiments were made for the purpose of determining the relation between the velocity of the wind and the pressure it exerts upon obstacles of various kinds exposed to it. The pressure-plates were placed at the end of the long arm of a whirling-machine which was rotated by steam-power. The author gives the results of experiments with about twenty-five different kinds of pressure-plates. The pressure upon a plane area of fairly compact form is about a pound and a half per square foot, at a velocity of twenty-one miles per hour; or, in other words, a pressure of one pound per square foot is caused by a wind of a little more than seventeen miles per hour. The pressure upon the same area is increased by increasing the perimeter. The pressure upon a ¼-foot plate is proportionally less than that upon a plate either half or double its size. The pressure upon any surface is but slightly altered by a cone or rim projecting at the back; a cone seeming to cause a slight increase, but a rim having apparently no effect. At the same meeting Dr. C. H. Blackley told of an improved method of preparing ozone paper, and other forms of the test, with starch and potassium iodide. Some years ago the author made some experiments with the ordinary ozone test papers, but found that the papers did not always give the same result when

two or more were exposed under precisely the same conditions. He subsequently tried what re-action would take place between unboiled starch and potassium iodide when exposed to the influence of ozone; but the difficulty of getting this spread evenly upon paper by hand, so as to insure a perfectly even tint after being acted upon by ozone, led him to devise a new method of accomplishing this. Briefly described, it may be said to be a method by which the starch is deposited on the surface of the paper by precipitation; and, for delicacy and precision in regulating the quantity on any given surface, it leaves very little to be desired.

— A large number of experiments have been carried out at Innsbruck by Professor Peyritsch, and are recorded in the "Transactions of the Imperial Academy of Vienna," vol. xcvii. i. p. 597, tending to show that double flowers may be artificially produced by the agency of a mite (*Phytoptus*). It seems that the professor was examining a wild double flower of *Valeriana tripteris*, and discovered that it was infested with the mites in question. He transferred these mites to other plants, chiefly of the orders *Valerianaceæ* and *Cruciferæ*, and a few *Scrophularineæ*, *Commelynaceæ*, and even others; but the best results were obtained in the first named. Various kinds of doubling were produced, such as petalody of the stamens and pistil, prolification and duplication of the corolla, etc., as well as torsions and fasciations of the shoot. The leaves were also affected, the margin showing teeth like those of a comb. By infecting the plant at different times, either the leaves or the flowers may be influenced, and it appears that the parasite must attack the organ in its earliest stages. Professor Peyritsch thinks that there are certain mites which produce double flowers in certain plants, as the mites in which he was particularly interested were always most abundant in certain species, and less so in others.

— The introduction of *Phylloxera* into Asia Minor appears to have been the result of a deliberate importation of the vines from a country where the disease was known to exist.

— An interesting note, by Mr. Arthur A. Rambaut, on some Japanese clocks lately purchased for the Dublin Science and Art Museum, has been reprinted from the "Proceedings of the Royal Dublin Society." These clocks, though differing in other respects, agree in this particular: that the time is recorded, not by a hand rotating about an axis, but by a pointer attached to the weight, which projects through a slit in the front of the clock-case. This pointer travels down a scale attached to the front of the clock, and thus points out the hour. Mr. Rambaut has consulted several persons who have been resident for some time in Japan, but none of them has ever seen clocks of like construction in actual use. A young Japanese gentleman to whom the specimens have been shown, says that he has heard of such clocks being used in rural parts of Japan about twenty or thirty years ago, but that they have been almost completely superseded by clocks made on the European plan.

— An international congress of chronometry will be opened at the National Observatory, Paris, on Sept. 7. An influential organizing committee has been formed, of which Vice-Admiral de Fauque de Jonquières has accepted the presidency. Those who wish to become members should communicate with the secretary, M. E. Caspari.

— *Engineering* reports that arrangements have been made for the despatch of another exploring and prospecting expedition for the Australian interior. The funds for the undertaking are to be chiefly provided by the Central Australian Exploring Association, which is an offshoot of the South Australian branch of the Geographical Society. Baron von Muller of Melbourne has taken an interest in the enterprise, and it is hoped that a portion of the funds available for exploration in the hands of the Geographical Society in Victoria will be placed at the disposal of the expedition. The leadership of the party has been undertaken by Mr. W. H. Tietkens, an experienced Australian explorer. The party will probably consist, in addition to the leader (upon whom will also devolve the duties of botanist, prospector, mineralogist, and surveyor), of three men and a black boy, with twelve camels, two horses, and provisions for six months. The starting-point will be Alice Springs, and the expedition, travelling ordinarily at the rate of one hundred miles per week, except when engaged in the work of prospecting, will proceed to Lake Amadens with a view to examining carefully the surrounding country.

— The Paris correspondent of the London *Daily News* says the Zoölogical Society of France has warned the French Government that a great ornithological calamity is impending. The Department of the Bouches du Rhône has hitherto been one of the chief landing-places for swallows coming from Africa. Engines for killing them, formed of wires connected with electrical batteries, have been laid in hundreds along the coast. When fatigued by their over-sea flight, the birds perch on the wires, and are struck dead. The bodies are then prepared for the milliner, and crates containing thousands of them are sent on to Paris. This has been going on for some years, and it has been noticed this spring that swallows have not landed on the low-lying coast, but have gone farther west or east, and that they go in larger numbers than formerly to other parts of Europe. There are places, says the Zoölogical Society in its petition, where they used to be very numerous, but which they have now deserted, although there has been no falling-off in the gnats and other flying insects on which they live.

— A sub-committee of the Royal Agricultural Society of South Australia has undertaken to raise subscriptions in aid of the destruction of sparrows in South Australia, and it is proposed to have monthly competitions in the production of sparrows' heads and sparrows' eggs. These competitions will take place after the next autumn show in Adelaide. At the autumn show there will be a grand prize competition, when prizes of £2, £1 10s., 10s., and 5s. will be offered for the largest numbers of sparrows' heads, and the same value in prize-money will also be offered for the largest numbers of sparrows' eggs. Additionally to this, every competitor who fails to secure a prize, and yet brings in one hundred or more heads or eggs, will receive a bonus of 2s. 6d., and any one producing under one hundred and not less than fifty heads or eggs will receive a bonus of 1s.

— A report comes to the Entomological Museum, Washington, from Mr. J. W. Beach of Batavia, Boone County, Ark., to the effect that a general alarm prevails in that section of the country for many miles around in regard to the chinch-bug. They did a considerable amount of damage there last year, and those that wintered over have already destroyed many fields of grain this spring. The wooded country in places is reported full of them; so much so, that the people are contemplating setting fire to their woodlands.

— The weight of the smoke-cloud which daily hangs over London has been estimated by Professor Chandler Roberts, says the *Engineering Times*, to amount to about 50 tons of solid carbon and 250 tons of carbon in the form of hydrocarbon and carbonic-oxide gases. Calculated from the actual result of tests made by the Smoke Abatement Committee, the value of coal wasted in smoke from domestic grates amounts, upon the annual consumption of 5,000,000 of people, to £2,256,500. The cost of cartage on this wasted coal is calculated to be £268,750, while the unnecessary passage of about 1,500,000 horses through the streets in drawing it, adds seriously to the cost of street cleaning and repairing. Then there is the cost of taking away the extra ashes, £43,000 per year. Summing it all up, the direct and indirect cost of waste coal may be set down at £2,600,000, plus the additional loss from the damage done to property caused by the smoky atmosphere, estimated by Mr. Chadwick at £2,000,000, the whole aggregating £4,600,000.

— "The Summer Care of Children" is made the subject of a timely paper in the June number of *Babyhood*, by Dr. H. D. Chapin. Equally practical is the article on "Nursery Cookery," by Dr. Sarah E. Post. Other articles of interest to parents are, "The Musical Education," "Where shall we spend the Summer?" "Botany for the Little Ones," etc. Much valuable advice is offered concerning earache, the promotion of the suckling power, and the many questions of food, dress, etc., asked by correspondents.

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THE VARIOUS MEDICAL ASSOCIATIONS and the medical profession will be glad to learn that Dr. John S. Billings, surgeon in the United States Army, has consented to take charge of the "Report on the Mortality and Vital Statistics of the United States," as returned by the eleventh census. As the United States has no system of registration of vital statistics, such as is relied upon by other civilized nations for the purpose of ascertaining the actual movement of population, our census affords the only opportunity of obtaining any thing near an approximate estimate of the birth and death rates of much the larger part of the country, which is entirely unprovided with any satisfactory system of State and municipal registration. In view of this, the Census Office, during the month of May this year, will issue to the medical profession throughout the country 'physician's registers' for the purpose of obtaining more accurate returns of deaths than it is possible for the enumerators to make. It is earnestly hoped that physicians in every part of the country will co-operate with the Census Office in this important work. The record should be kept from June 1, 1889, to May 31, 1890. Nearly 26,000 of these registration-books were filled up and returned to the office in 1880, and nearly all of them used for statistical purposes. It is hoped that double this number will be obtained for the eleventh census. Physicians not receiving registers can obtain them by sending their names and addresses to the Census Office; and with the register, an official envelope, which requires no stamp, will be provided for their return to Washington. If all medical and surgical practitioners throughout the country will lend their aid, the mortality and vital statistics of the eleventh census will be more comprehensive and complete than they have ever been. Every physician should take a personal pride in having this report as full and accurate as it is possible to make it. All information obtained through this source will be held strictly confidential. It is equally important to the country that the returns in relation to farm-products and live-stock should be full and correct. The enumerator in the house-to-house visit he will make during the month of June, 1890, is constantly met with the fact that farmers keep no books, and hence returns are not infrequently guess-work. The census year begins June 1 next, and ends May 31, 1890. If farmers throughout the country would note this fact, and keep account of the products of their farms during the census year, it would be of material aid in securing reliable returns for the eleventh census.

SOME ONE RECENTLY SENT Professor C. M. Woodward, director of the Manual Training School, Washington University, St. Louis, Mo., a copy of a small periodical called "Microcosm," in which there was a prize essay by a Mr. Reuben Hawkins of Chillicothe, Mo., which has some interest. This article Professor Woodward picks to pieces in *The Teacher* for May. The author begins by quoting the familiar ideal experiment of firing a cannon-ball horizontally from the top of a tower, under the assumption that the force of gravity is constant, and that there is no resisting medium. The question is as to the time occupied in reaching a lower horizontal plane. Mr. Hawkins says that the common answer that the time occupied by the projectile is the same as the time occupied by a ball falling vertically from the muzzle of the gun to the same horizontal plane, is wrong, and his prize money is won by an argument in support of his assertion. Professor Woodward states that he has no idea who Mr. Hawkins is, nor does he know what facilities he has had for acquiring correct notions of mechanics and correct methods of reasoning, and had his essay not been indorsed by the editor, A. Wilford Hall, Ph.D., LL.D., in a commendatory note as well as by a prize, he should not have spent a moment on it. But when he sees such unspeakable trash commended and rewarded by a man who claims to have some understanding of the principles of physics, he feels constrained to protest. Mr. Hawkins's argument begins with some propositions in regard to the resultant of two forces acting on the same body, substantially as follows: If two equal forces act in direct opposition, the resultant is nothing. If two equal forces act in the same direction or in conjunction, the resultant is equal to their sum, or twice one of the component forces. Now, if one of the forces is turned to a mean position between the two just considered, that is, to a position at right angles to the second force, or in "half position" as Mr. Hawkins calls it, the resultant must be the mean of the former resultants. The mean of zero and two is one. Hence the resultant of two forces at right angles to each other is just equal to one of them. All this, and more of the same kind, Dr. Hall indorses as follows: "The foregoing article from the able pen of Mr. Hawkins was written substantially before our prize offer was published. From its highly scientific character, however, and from the fact that this number of the *Microcosm* will reach more than twenty thousand professors and teachers, we deemed it important to give it the position of Prize Essay No. 1." How far such teaching may do mischief is a question, but its existence is worthy of occasional note.

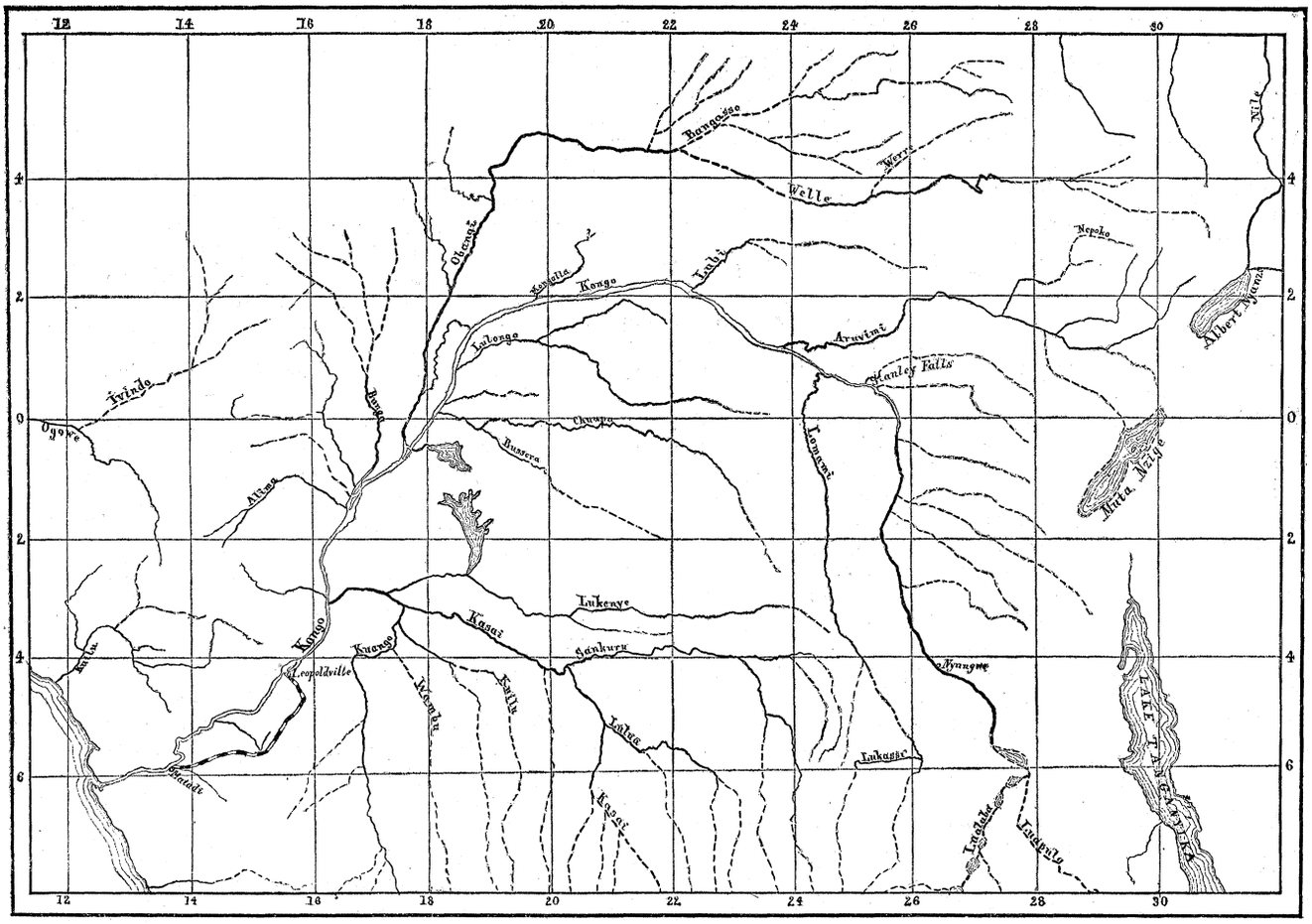
RECENT DISCOVERIES IN CENTRAL AFRICA.

THE results of Van Gèle's exploration of the Obangi, of Junker's discoveries on the Upper Welle, Stanley's great journey up the Aruvimi, and Delcommune's ascent of the Lomami, have materially added to our knowledge of Central Africa, the river systems of

which were, until a few years ago, one of the most baffling problems to geographers. On the accompanying sketch-map the rivers of Central Africa are shown according to the present state of our knowledge. The numerous large rivers south of the great bend of the Kongo offer an excellent means of communication, and will undoubtedly be of great help to the commercial development of that region. The hopes that were for some time entertained, of finding an equally valuable commercial route north of the Kongo, have not been fulfilled, navigation being interrupted by numerous rapids. Stanley's expedition has proved that there is no prospect of ever opening a trade-route from Stanley Falls to the Albert Nyanza, and hat the natural outlet of the lake region must be by way of the east coast. On the other hand, Mr. Delcommune's ascent of the Lomami has proved that the market of Nyangwe is easily accessible from the west coast, the river being navigable at a point only three

no serious obstacles are found on the route, and that the cost of construction will be moderate. It is estimated that the journey from Matadi to Stanley Pool will occupy two days. Thus the termini of navigation on the upper and lower river will be connected by an easy route. The commercial examination of the interior seems to give good promise, and ere long we shall see a trade spring up sufficient to warrant the construction of a railroad. At present serious attention is given to the improvement of the caravan-route near the bank of the Kongo. The attempts at stock-raising are giving fair results, and soon transport on carts drawn by oxen, or on the back of oxen, will take the place of the caravans of carriers.

According to the *Mouvement géographique*, the general trade of the Kongo Free State amounts at present to 7,392,348.17 francs, or approximately $1,500,000, the staple produce being palm-kernels,



MAP SHOWING RECENT DISCOVERIES IN CENTRAL AFRICA.

days' journey distant from Nyangwe. The importance of this fact cannot be rated too highly. Stanley Falls seemed to be the terminus of navigation on the Kongo; and the countries Urua and Katanga, which were first visited by Reichard, appeared to be almost inaccessible. The Lomami, however, offers an easy means of access, and will lead to the opening of these remote regions. This is the more important, as, according to Reichard, the Lualaba above Nyangwe is navigable as far as Lake Upemba.

As will be seen from our map, there remains one great unknown country bounded by the Kongo on the west side, and by a line running from the north point of Lake Tanganyika to the south point of Lake Albert Nyanza on the east side. In this region the Arabs have recently made rapid progress, and villages are being devastated and depopulated. Trade is being organized at the cost of the well-being of the natives, and the great markets on the Kongo are supplied by the slave-caravans ravaging this region.

In the present map the planned railroad from Matadi to Leopoldville has also been indicated. The surveys have proved that

ivory, and palm-oil. Coffee has recently attained considerable importance. The growth of the state is such, that, for administrative purposes, it had to be divided into eleven districts, each of which, two only excepted, has its chief station. Three of these districts comprise the Lower Kongo, five the Upper Kongo and the adjacent territory, one the Kasai, one the Aruvimi and Welle, and the last the Lualaba.

The rapid progress in opening Central Africa, starting from the west coast, is the more welcome, as there seems to be no end to the political complications in East Africa. Although Lieut. Wissmann has defeated the Arabs, their resistance has not been broken, and it is doubtful how far into the interior his influence will expand. Military expeditions into the interior of Central Africa are hardly possible, on account of the vastness of the territory and the difficulties offered by the climate, and the effects of long-continued wars must be to close the routes from Zanzibar to the lake region. If the Kongo Free State is successful in keeping the devastating slave-trade out of the greater part of its territory, it will doubtless

be successful in opening Central Africa to the influence of European civilization, to the benefit of both the African and the needs of our culture.

A SANDY SIMOOM IN THE NORTH-WEST.[1]

MAY 6 and 7, 1889, will long be remembered by the residents of the North-west. On those days culminated the violence of the dry, south-easterly wind which had prevailed in some portions of the North-west, particularly in central and eastern Dakota, for several days previous. The wind itself, while not specially violent, varying from twenty to forty miles an hour, and perhaps in some places fifty miles an hour, was remarkable for carrying with it clouds of dust and sand, which filled the air and penetrated into houses, and blinded the traveller who happened to be caught in the roads, and compelled the cessation of nearly all outside labor. The wind prevailed over a large area. It seems to have reached farthest east, and been most violent, on the 6th and 7th of the month. The newspapers gave telegraphic accounts of it in Nebraska, South and North Dakota, Iowa, and Minnesota. It probably also affected western Wisconsin and considerable portions of Missouri.

A strong south-easterly parching wind, prevailing for several days, about that time in the spring, is a familiar fact to old residents who have taken note of the peculiarities of the north-western climate. It more frequently comes after spring vegetation is more advanced than it was this season on the days mentioned; and its effect on small, tender twigs is disastrous. It is enervating to all animals, and merciless on the wilting vegetation. But prior to this wind, which was followed everywhere by copious rains, the spring of 1889 in the North-west had been dry; and this was intensified in its effect on young vegetation by the preceding dry and open winter. All springs and streams were unwontedly low: hence the soil was loose, and exposed to the attack of this wind. Grass was not so large as usual, and did not shield the soil. Extensive prairie and forest fires had recently denuded large tracts of much of the protection which vegetation otherwise would have furnished. Circumstances were favorable, therefore, for the air to become filled with flying particles, caught up from the ploughed fields, from the blackened prairies, from the public roads, and from all sandy plains. These particles formed dense clouds, and rendered it as impossible to withstand the blast as it is to resist the blizzard which carries snow in the winter over the same region. The soil to the depth of four or five inches in some places was torn up, and scattered in all directions. Drifts of sand were formed, in favorable places, several feet deep, packed precisely as snow-drifts are under a blizzard. It seemed as if there were great sheets of dust and dirt blown recklessly in mid-air; and when the wind died down for a few moments, the dirt, fine and white, almost seemed to lie in layers in the atmosphere, clouding the sun, and hiding it entirely from sight for an hour or more at a time. It was so fine, and penetrated the clothing so, that life was burdensome to those who must face the storm. Mr. C. W. Fink of Woolsley, near Huron, Dak., stated that it was almost impossible to live out of doors at some periods of the storm, and that he would "much rather take his chances in the big blizzard of two years ago." While on his way to St. Paul over the St. Paul, Minneapolis, and Manitoba Railroad, Mr. Fink said the train passed through what was apparently a storm of fine dust which seemed to be almost white. It looked much like a snow-storm, and the sun was hid. It was impossible to distinguish obstacles at a distance of more than a few feet away. These phenomena in their intensity did not appear at Minneapolis; but they were witnessed in the more open or originally prairie tracts, and are given on the authority of others. During a residence of seventeen years at Minneapolis, the writer has not before witnessed any thing that would compare with this simoom-like storm.

The occurrence of this storm has a bearing on theories of the origin of the loess. Its area is that over which the loess is abundant. It would not take long for any beholder to be convinced that there was enough material being transported in the wind to constitute, when deposited in water, or even piled up as dunes and spread as surface sheets, after a few years, a stratum as thick as, and constituted like, that of the Missouri-Mississippi Valley. Given such a wind over the same region, periodically, under the same parched condition of the surface, it would only require an expanse of water in which this dust could settle, to form a loess clay, or loam. With the accompanying and following rains, other particles would be washed down from the lands, mingling with some strata of sand or of gravel, and a transition from loess to drift-sand would be built up such as has been described in several places.

[1] From the American Geologist.

THE SPIDER-BITE QUESTION.

THE following item appeared in the *Evening Star* (Washington) for March 12, 1889, and is a fair sample of the newspaper reports in reference to spider-bites which are so common: "Mr. Tileston F. Chambers, son of Mr. D. A. Chambers of this city, came home from Princeton with several fellow-students to spend the inauguration holidays. On Saturday, March 2, he was bitten twice on the arm by what the doctor said must have been a black spider, with the most alarming results. Blood-poisoning and jaundice followed, but by careful treatment he is now rapidly recovering. The physician said that another bite would undoubtedly have proved fatal."

Learning by correspondence from Mr. D. A. Chambers that the physician in charge was Dr. Z. T. Sowers of Washington, a well-known and prominent practitioner, a representative of the Entomological Bureau, Washington, called upon Dr. Sowers, who stated that he knew little more than was given in the newspaper statement. He said that he had had several such cases in his practice, and that he was accustomed to attribute these bites to black spiders, for the reason that he knew of no other insect found in such localities which could produce the effect. The room in which young Mr. Chambers was bitten was one which had long been disused, and he occupied it on the night of March 2, for the reason that the rest of the house was full of inauguration visitors. Thus there is nothing special connected with this instance.

Professor Riley, United States entomologist, is under the impression that certain of these cases result from the bite of the blood-sucking cone-nose (*Conorrhinus sanguisuga*), — an insect which is occasionally found in houses, and which is able to inflict a very severe wound with its beak.

Evidence in regard to fatal bites is very weak, with the exception of the genus *Latrodectus*, and this genus is never found in outhouses or disused rooms. Dr. Elliott Coues calls attention to the fact, that, if the *Latrodectus* stories are true, we have a case in this creature of the most powerful poison known. With the most poisonous snakes an appreciable quantity of poison, say one or two drops, is injected into the wound, but with the *Latrodectus* an infinitely smaller quantity seems to produce as strong an effect.

In this connection the editor of *Insect Life* quotes an item for the reliability of which the *Scientific American* is responsible: "Professor Breeger has recently investigated the poisons of spiders. He found that the Russian varieties of spider, *Phalanchium* and *Trochosa* (*Tarantula*), are non-poisonous, but that a third, *Caracurt*, or 'black wolf,' secretes a powerful poison, forming twenty-five per cent of its whole weight. This substance is a peculiar unstable alkaloid, destroyed at 60° C. or by alcohol. Introduced into the circulation of warm-blooded animals, one-thirtieth of a milligram per kilogram of the animal treated was sufficient to cause death. It exceeds in power all known vegetable principles and prussic acid, being comparable in toxicity with the poison of snakes."

The following letter from Mr. R. Allan Wight of New Zealand, also bearing on the subject, is appended: "What Dr. Wright told you about the *Katipo* is perfectly correct. I was then living close by, and knew all the parties and all the circumstances, and my sons also remember it all. It was as clear a case of *Katipo* poisoning as possible; and the man said he saw the spider bite him, and minutely described the spider, which description tallied exactly with its proper one. A case occurred at Whangarei a few weeks ago, where a man was bitten and suffered a good deal, and I have written to the medical man who attended him, and will let you know the result. I am also going soon on another long tour

in the north, where I shall be able to get many tales and reliable information from both natives and white men as to the *Katipo*, and will let you know when I come back. I drove over to a man who is said to have lost his arm through a *Katipo*, but I found that he does not know one when he sees it, did not see the bite inflicted, was in a place where the *Katipo* does not live, and when the arm was removed the bone was diseased (honeycombed). That is one of those tales people hear, and which make it difficult to believe any thing. I feel certain the *Katipo* is a very dangerously poisonous spider, but I never but once saw a case with my own eyes. It was many years ago, and I was out with a war party of Maoris. One night we found ourselves in an unpleasant position, as far as they were concerned. On our rear there were a number of nice hollow places to sleep in; but as these were Maori ovens, in which men had been cooked for a cannibal feast, the natives not only would not sleep in them, but they would not let me: so we lay down on the bare shingle beach, with no tent, in a high wind, and before us at a short distance was an island that is (they say) inhabited by evil spirits; so, with spirits both before and behind, we lay awake, talking in subdued whispers.

"I had my head on a rush bush; but they would have me shift it on to a rock, because they said the *Katipo* lived in the rushes by the seaside. I was anxious for them to sleep, knowing that tomorrow we would want all our strengh; but it was no use, for by and by a man screamed out that the *Katipo* had bitten him, and in a moment lights were brought, and, sure enough, the *Katipo* was there, within a foot of the wound, under his mat. The arm swelled, but not so much as to give alarm. What alarmed me more were his weakness and languor, and the lowness of his pulse and his heart-action. The poison certainly was a powerful narcotic, if symptoms go for any thing. I gave him all the brandy we had, and the natives pretty well burned his wound, and rubbed and rubbed at him till they got him into a perspiration; but he did not properly recover for several days, and, if one had only known, it would have been a mercy to have let him die (which I believe he would). So I thought when I saw him gasping his life away with blood and froth flowing from his mouth. Ugh! That is one of the several scenes I do not care to think about. By the by, I could not get the specimen. The Maoris burned it, as they said the *Katipo* is an 'evil spirit, and, if we did not burn it, the man would die.' I have many chiefs here, and I asked them only to-day, but no one ever heard of but one *Katipo*, — the black spider, with a vermilion spot on the abdomen."

BOOK-REVIEWS.

A Text-Book of Pathology, Systematic and Practical. By D. J. HAMILTON, M.B. Vol. I. London and New York, Macmillan. 8°. $6.25.

FROM the pen of the professor of pathological anatomy of the University of Aberdeen we should expect a text-book of pathology which would be both systematic and practical, and we are not disappointed. The first volume only has been published; but the second is in process of preparation, and will be issued with the least possible delay. The contents of the volume before us are divided into three parts. Part I. treats of the technique, including the *sectio cadaveris*, or autopsy, the preparation of tissues for detailed examination, and the microscope. In this portion of the work, practical bacteriology also is discussed. Part II. deals with general pathological processes, including infiltrations and degenerations, inflammation, suppuration, healing and organization, ulceration, and dropsy. In Part III. we find considered diseases of the various organs and tissues, new formations and tumors, diseases of the blood, the heart, and the blood-vessels. In an appendix are thoroughly described the methods of making casts and models, which are most important adjuncts to every pathological museum. The author promises us that in the second volume he will discuss systematic bacteriology *in extenso;* and, as this subject has now become so important, we shall look for this volume with great interest. The methods described in the volume before us are, as a rule, the most advanced and the best. We think that the method of making Esmarch's tubes might have received more attention than has been given to it, on account of its advantages over Koch's plate method. Nothing is said of rolling these tubes on ice, which is now done in most of the American laboratories, perhaps for the reason that the method is not known in the British Isles. It will be found by those who try it superior to cold water. Taken as a whole, we have nothing but praise for Mr. Hamilton's book; and, if it receives the attention of the medical profession of this country as it deserves, it will soon become the leading text-book of pathology in our medical colleges.

Elementary Text-Book of Zoölogy. By Dr. C. CLAUS. Tr. and ed. by Adam Sedgwick, M.A., and F. G. Heathcote, M.A. 2 vols. 2d ed. London and New York, Macmillan. 8°. $8.

MR. SEDGWICK, lecturer of Trinity College, Cambridge, and examiner in zoölogy in the University of London, undertook the translation of this work of Claus ("Lehrbuch der Zoologie") to supply a want, which had long been felt in England by both teachers and students, of a good elementary book on this subject. The reputation of Professor Claus's works on zoölogy in Germany, and indeed throughout the civilized world, naturally suggested this one to Professor Sedgwick as the one best adapted to supply the deficiency which existed, and in the two volumes before us we have the most complete elementary text-book on this subject in the English language. Others, to the extent to which they go in the treatment of special subjects, may be equally good; but none that we have seen can claim the same degree of excellence and completeness combined. The work is illustrated with 706 woodcuts; and as to its general excellence, we need but call attention to who its publishers are.

Pestalozzi: his Aim and Work. By BARON ROGER DE GUIMPS. Tr. by Margaret C. Crombie. Syracuse, C. W. Bardeen. 12°. $1.50.

THIS is a convenient biography of Pestalozzi by one of his own disciples; and Miss Crombie has rendered a service to English and American educators by bringing it out in their own language. The arrangement of the work is not always the best, and some points are not made so clear as might be wished; but nevertheless it gives a very fair account of Pestalozzi's life, and of his educational theory and practice. He was born in 1746, and quite early showed that interest in the education and moral elevation of the masses which was the ruling motive of his life. He first undertook to be a clergyman, but, not succeeding in that profession, attempted that of law, from which he was excluded by the Swiss authorities, to whom his political views were obnoxious. He then engaged for some years in farming, having in the mean time taken a wife; but his want of business skill led to ultimate failure, so that he was reduced almost to beggary. After this he tried his hand at authorship, in which he had some successes and some failures; and it was not until he was over fifty years of age that he found his true vocation of teaching, which thereafter continued to be his occupation most of the time during the remaining thirty years of his life. Every one of his schools ultimately came to a disastrous end, owing in great part to his own want of business skill and managing tact. Nevertheless, he was able to put in practice his new method of teaching, which, in the opinion of his admirers, is the greatest improvement ever made in education.

What this method was, his biographer does his best to explain yet he confesses in the end that "the world has not yet got a clear answer to the oft-repeated question, 'What is Pestalozzi's method?'" It seems evident, however, that it consisted mainly in what are now called object-lessons combined with drawing, while learning from books was almost totally excluded. He had, we are told, an utter contempt for book-learning, and he seems to have thought that the whole educational practice of the world for two thousand years had been wrong, and that nothing but a revolution would set things right. The accounts given in this book, however, do not justify any such inference. Pestalozzi tried his method first on his own son, with the result that the boy was not educated at all, but grew up an ignoramus. At the age of eleven he could not read, and when, at fourteen, he was sent to school, he made a complete failure in his studies, as he afterwards did in business. It is clear that Pestalozzi's method was only adapted to the earliest

years of school-life ; and his biographer expressly says that older pupils who came to him for instruction went away disappointed. In short, his method, as modified and applied by his successors, has proved a useful auxiliary in early childhood to the regular system of education ; but that is all that can be claimed for it. His love of children, however, and his ardent interest in the poor and ignorant, with his lifelong efforts for their improvement and elevation, are worthy of all praise. It is these noble qualities of the man that give the chief interest to his biography ; and there is not a teacher anywhere that cannot learn something in this respect by a perusal of this work.

The Electric Motor and its Applications. By MARTIN and WETZLER. New York, W. J. Johnston. 4°. $3.

THIS is a revised and enlarged edition of a work first published about two years ago, and reviewed in these columns at that time. While considerable space is given to the theoretical and historical views of the electric motor, the book is mainly devoted to its more modern development and application. The present work is in great part a reprint of the first edition, to which have been added nearly a hundred pages of new matter, thus giving a complete review of the subject treated down to the end of 1888. The new chapters contain a description of all the noteworthy motors and electric-railway systems introduced since the publication of the earlier edition, as well as a discussion of alternating-current and thermomagnetic motors. Thus the new portion of the book not only comprises instances in which electric power has advanced from the experimental stage to that of successful practice, but also casts a glance at the results which the future may be expected to yield. The book is worthy a place in the library of every electrician, and to the general reader it is not without interest.

Examination of Water for Sanitary and Technical Purposes. By HENRY LEFFMANN and WILLIAM BEAM. Philadelphia, Blakiston. $1.25.

THIS is an admirable little manual of one hundred and six pages, giving in clear and concise language the most trustworthy and practicable processes for the examination of water. The soap-test for the determination of the hardness of water, which has been so long in use by chemists, has been abandoned by the authors as inaccurate, and in its place they have recommended the method devised by Hehner, in which sodium carbonate and sulphuric acid are employed. For the determination of nitrate and nitrites the calorimetric tests are advised to the exclusion of the more troublesome and uncertain processes heretofore in use. In order to have the advanced nomenclature and notation of the present time kept constantly in mind, a set of labels for the re-agents has been provided, and is furnished with the book. Among the special features of this volume are the chapters describing the action of water on lead, and the technical application to be deduced from an analysis of a given specimen of water, its action on boilers, etc.

The Bacteria in Asiatic Cholera. By E. KLEIN, M.D. London and New York, Macmillan. 16°. $1.25.

THIS volume is a reprint of a series of articles published in the *Practitioner* in 1886 and 1887, together with a number of contributions which have since been made to the knowledge of the comma bacilli of Koch. Klein may be regarded as the most pronounced opponent of Koch's theory that the comma bacillus is the cause of Asiatic cholera. That he is, however, not the only one, is shown by the statement in the volume before us, that Baumgarten, Pettenkofer, and Emmerich in Germany ; Roy, Sherrington, and Brown in England ; and Shakspeare in America, — hold the same opinion as Klein. While denying the causal relation between the comma bacillus of Koch and *Cholera Asiatica*, Klein, nevertheless, recognizes its diagnostic importance. On this point he says he agrees to the proposition, that, if in any case of diarrhœa the choleraic comma bacilli can be shown both by the microscope and by culture-experiments to exist, then the suspicion that it may be a case of Asiatic cholera is quite justified : for if it should be found, that, in a locality which is in communication by sea or land with an infected country, one or more suspicious cases of diarrhœa had occurred, the demonstrations by culture-experiments of the presence in the intestinal discharges of the choleraic comma bacilli would fully justify us in regarding such cases with grave suspicion as being probably, though not necessarily, choleraic. At all events, sanitary officers, for the sake of the public weal, would be justified in treating these cases as cases of cholera, and in taking measures of isolation and disinfection. It is impossible at the present time to decide between such men as Koch and Klein and their adherents. Each day new facts are being discovered, and views which seemed to rest on a firm foundation have had to be abandoned in the light of newly discovered evidence. Klein shows very plainly that many of Koch's earlier statements in reference to the presence or absence of the comma bacillus have already required great modifications. Fortunate it is that all are agreed, that, whether Koch's comma bacillus cause the Asiatic cholera or not, its presence is sufficient evidence of the existence of that disease to demand of sanitary officials the most rigid isolation of the suspicious case, and the most thorough disinfection of his clothing and surroundings.

First Book of Nature. By JAMES E. TALMAGE. Salt Lake City, Utah, Contributor Company.

THIS little book is designed to assist in the elementary study of the simplest objects of nature, — such as all people have more or less necessity of dealing with, — and as a help to mothers, and teachers in primary schools, will prove of great assistance. It deals with the simplest facts in the animal, vegetable, and mineral kingdoms, and such facts as every one ought to know. The ignorance of many of these simple facts on the part of many persons who are presumably educated is both lamentable and ridiculous. In a legal trial which occurred some time since, in which complaint was made that a crowing rooster was a nuisance, and kept in violation of an ordinance prohibiting the keeping of noisy animals in the city, it was maintained that an action could not lie, because a rooster was not an animal. Had those who held this opinion read this "First Book of Nature," such a blunder could not have been made.

AMONG THE PUBLISHERS.

"THE Voltaic Accumulator," an elementary treatise by Emile Reynier, translated from the French by J. A. Berly, C.E. (New York, E. & F. N. Spon), describes in a didactic manner the whole of the practical and scientific acquisitions made in the domain of the voltaic accumulator from Planté to our days. It brings together, summarizes, explains, and classifies the notions, theories, and inventions relating to secondary currents, and reviews the principal applications of the latter.

— "Eight Hundred Miles in an Ambulance" is the title of a little volume of papers republished from *Lippincott's Magazine*, and describing the adventures of Mrs. Laura Winthrop Johnson in a journey across the Western plains with an army paymaster.

— Mr. B. P. Shillaber (Mrs. Partington) is writing his reminiscences of the last half-century.

— P. Blakiston, Son, & Co., medical and scientific publishers, booksellers, and importers, 1012 Walnut Street, Philadelphia, have just published the "Medical Directory of Philadelphia and Camden, 1889," containing lists of physicians of all schools of practice, dentists, druggists, veterinarians, and chemists, with information concerning medical societies, colleges, and associations, hospitals, asylums, charities, etc. ; and "A Manual of Chemistry," for the use of medical students, by Brandreth Symonds, A.M., M.D., assistant physician Roosevelt Hospital, out-patient department, and attending physician Northwestern Dispensary, New York.

— Robert Carter & Brothers will publish, by arrangement with the author and English publisher, the autobiography of John G. Paton, missionary to the New Hebrides.

— John Wiley & Sons announce "Philosophy of the Steam-Engine Developed," by Professor Robert H. Thurston ; "Composition, Digestibility, and Nutritive Value of Food," by Professor H. A. Mott ; and "General Motions of the Atmosphere, Cyclones, Tornadoes, Water-Spouts, Hail-Stones, etc.," by Professor William Ferrel.

— *The American Garden* of New York has taken another step forward by the incorporation of its business under the title of "The Garden Publishing Company, Limited." The management goes on largely in the same hands, but with the more intimate connection of several able men, who really have had much to do in making *The American Garden* what it has become; and, with increased means, the editor expects to more rapidly improve the magazine, and increase the business in proper lines. The organization of the new company stands as follows: Lawson Valentine, president; Charles Barnard, vice-president; L. H. Bailey; John DeWolf, secretary; Edgar H. Libby, treasurer. Mr. Valentine is also president of the Christian Union Company; a prominent member of the great publishing-house of Houghton, Mifflin, & Co., owner of Houghton Farm; and president of the Lawson Valentine Company, makers of fine varnishes. Mr. Barnard is connected with The Century Company, author of that wonderfully successful drama, "The County Fair," author of numerous successful books on technical subjects, and a practical horticulturist as well. Professor Bailey is head of the new horticultural department at Cornell University, and a thoroughly practical man of wide experience. Mr. DeWolf is a professional landscape-gardener, for several years head of the art department and assistant editor of *The American Garden*. Mr. Libby has been the editor and publisher for four years and a half, and has pushed the business with hard work and exceptional skill.

— The editorial management of the *North American Review* is at present in the hands of Mr. William H. Rideing.

— Macmillan & Co. will publish shortly an appendix to Grove's "Dictionary of Music and Musicians," which completes the fourth and concluding volume of the work. A full index to the work is in preparation, which will be published later in a separate volume.

Publications received at Editor's Office, May 27–June 1.

DAWSON, G. M. Report on an Exploration in the Yukon District, N.W.T., and Adjacent Northern Portion of British Columbia, 1887. Montreal, Dawson Bros. 277 p. 8°. 30 cents.

EMERSON, R. W. The Fortune of the Republic and other American Addresses. (Riverside Literature Series, No. 42.) Boston and New York, Houghton, Mifflin, & Co. 109 p. 16°. 15 cents.

GRIMES, J. S. Geonomy: Creation of the Continents by the Ocean Currents. And Kosmo-nomia: the Growth of Worlds and the Cause of Gravitation. Philadelphia, Lippincott. 139 p. 16°. 50 cents.

KELLOGG, M. M. Tullii Ciceronis Brutus de Claris Oratoribus. Boston and London, Ginn. 196 p. 12°.

KING, C. "Laramie;" or, The Queen of Bedlam. A Story of the Sioux War of 1876. Philadelphia, Lippincott. 277 p. 12°. $1.

SANBORN, J. W. Go to the Ant and learn Many Wonderful Things. Cincinnati, Cranston & Stowe; New York, Hunt & Eaton. 119 p. 12°.

THOMSON, J. Travels in the Atlas and Southern Morocco. New York, Longmans, Green, & Co. 488 p. 12°. $3.

VIGNOLES, O. J. Life of Charles Blacker Vignoles. London and New York, Longmans, Green, & Co. 407 p. 8°. $5.

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OPINIONS OF EMINENT GEOLOGISTS.

Yale University. Professor James D. Dana.
"Well fitted for the use of instruction in the science."

Professor Addison E. Virrill.
"It will be of very great advantage in the teaching of geology."

Harvard University. Professor N. S. Shaler.
"An extremely useful adjunct to our means of illustration."

Johns Hopkins University. President D. C. Gilman.
"Wherever American geology is taught your map should be a part of the apparatus."

Pennsylvania University. Professor Geo. A. Koenig.
"The map will be of special use in schools, which can only devote a short time to the study of Geology."

Michigan University. Professor Alexander Winchell.
"It seems to me that the device will commend the study of Geology to many persons who might otherwise regard the subject as difficult and uninviting. The work prepared by Mr. Ives ought to be used extensively in American schools."

Cornell University. Professor H. Shaler Williams.
"A valuable aid to teachers of geology as a means of graphically representing the grand facts of stratigraphy in the Eastern United States."

Columbia College, New York. Professor J. S. Newberry.
"A valuable aid in teaching geology, giving as it does to the student a clear idea of the superposition of the different geological systems at a glance."

Dartmouth College, Hanover, N. H. Professor C. H. Hitchcock.
"Am satisfied that its use will greatly assist students to understand the geological structure of the country."

Academy of Natural Sciences of Philadelphia. Professor Angelo Heilprin.
"The representation of Strata, as imposed one upon the other, by means of cardboard is certainly a good plan, for apart from rendering more intelligible the general expressions of the Map, it permits of ready alteration and the possibility of constantly bringing the map up to date, in other words to make it conform to more recent discoveries."

Boston Society of Natural History. Professor Alpheus Hyatt.
"Your map representing superposition and the various phenomena of geological science, so far as the distribution of rocks on this continent is concerned, has greatly interested me. I think that in the hands of a good teacher it would prove an efficient and useful adjunct in the teaching of geology."

American Museum of Natural History. Professor R. P. Whitfield.
"In the direction of a want long felt by Teachers of Geology and will undoubtedly be appreciated by them as well as by the student."

U. S. Geological Survey. Major J. W. Powell, Director
"After examination I am able to state that the work has been executed with care and fidelity, and I believe it will be a valuable aid to teachers."

New York State Survey. Professor James Hall, State Geologist
"I believe that maps constructed upon this method would be extremely useful in the hands of competent teachers."

Pennsylvania Survey. Professor J. P. Lesley, State Geologist.
"A piece of new and useful apparatus for teaching Geology, by representing to the eye of the student the areas of superimposed formations. I cordially recommend it to teachers and students."

New Jersey Survey. Professor Geo. H. Cook, State Geologist.
"It is very neatly done and must prove a great help to intelligent teaching and studying of Geological Science."

N. D. C. HODGES, 47 Lafayette Place, New York, N. Y.

— E. & F. N. Spon announce as in preparation "The Engineers' Sketch-Book of Mechanical Movements, Devices, Appliances, Contrivances, Details, etc.," by T. W. Barber; "Public Institutions: their Engineering, Sanitary, and other Appliances, with the Construction of Special Departments," by F. Colyer; "Practical Gold Mining," a comprehensive treatise on the origin and occurrence of gold-bearing gravels, rocks, and ores, and the methods by which the gold is extracted, by C. G. W. Lock; and "Egyptian Irrigation," by W. Willcocks.

— The Baker & Taylor Company announce for early publication, "The Drill-Master in German, based on Systematic Gradation and Steady Repetition," by Solomon Deutsch, Ph.D., author of "Letters for Self-Instruction in German," etc. This work the author claims to be an application of the principle of presenting but one difficulty at a time, and illustrating and explaining it so fully and by such numerous examples that it has ceased to be a difficulty before another step is taken. It is sought less to give grammatical instruction than to cause the language itself to be so learned that the student without a thought of grammar would never use it except in a grammatical manner. They also announce a "Genealogy of the Farnham Family," by J. M. W. Farnham.

— A. S. Barnes & Co. will publish at once Ex-United States Minister Theodore S. Fay's long-promised work, "The Three Germanies." Dr. Philip Schaff, who read the work in manuscript, says of it, "Few men have had better opportunities to study the history of Germany than Theodore S. Fay, who for twenty-five years occupied diplomatic positions in the service of the United States at Berlin, London, and Berne, and has been residing near Berlin since his retirement from public life. He was an eye-witness of the important events of 1848, 1866, and 1870. His personal experience and long observation give a fresh and life-like character to his interesting work on 'The Three Germanies,' especially the greater part of the second volume from the reign of King Frederick William III., to the death of Emperor Frederick III. in June, 1888."

— The Worthington Company have ready a large-paper edition (limited to 500 copies) of David M. Main's "Treasury of English Sonnets."

— Mrs. Humphry Ward has given up her visit to this country.

— An outcome of Professor J. P. Mahaffy's tour of Greece will be a book on the monasteries of that country.

— Margaret Deland's new novel will be entitled "Sidney Page." Though not dealing directly with theology, it will have a religious motive.

— The Duke of Argyll has written a new work, entitled "What is Truth?" in which the question is considered from a scientific as well as from a theological point of view.

— Marion Crawford's "With the Immortals" is being translated into French, and Rénan will contribute a preface. The French Academy has awarded to Mr. Crawford a prize of two hundred dollars for his two novels written by himself in French, and entitled "Zoroastre" and "Le Crucifix de Marzio."

— Mr. Josesph Thomson, the author of "Through Masai-Land," and as an African traveller second only to Stanley, has just written a book on his recent explorations, "Travels in the Atlas and Southern Morocco," which will be published immediately in New York by Longmans, Green, & Co. It will contain six maps and more than sixty illustrations.

— Alfred R. Conkling of New York, the nephew of Roscoe Conkling, generally known as Alderman Conkling, has about completed the work of collecting material for his life of his uncle, and has a portion of the book already written. He expects to have the entire work ready for the press in October. The publishers will be Charles L. Webster & Co.

— D. C. Heath & Co. have become the American publishers of the Isaac Pitman's shorthand books. They will shortly publish De Garmo's "Essentials of Method." The function of the book is to discover, through "an analysis of the mental activities involved in knowing, what are the essential elements of good method in teaching." It is accompanied by practical illustrations showing "the application of the general laws of right method to all the branches of the common school curriculum."

— The Long Island Historical Society will soon print, for subscribers, about one hundred and fifty unpublished letters of Washington, from its manuscript collections, in a large and handsome octavo volume, entitled "George Washington and Mount Vernon." It will contain a portrait of Washington, not heretofore engraved, from an original painting by Charles Peale (1787), owned by the Rev. Mason Gallagher of Brooklyn; also a portrait of Betty Lewis, Washington's only sister. The historical introduction and annotations will be prepared by Mr. Moncure D. Conway, biographer of Edmund Randolph.

— L. Prang & Co. have published a little booklet containing illustrations in color of the mayflower and the golden-rod, with charming verses by Hopewell Goodwin, in which each flower sets forth its own merits to the choice for America's national flower. Its object is chiefly to decide which of the two is considered the most popular flower, and which therefore might be considered the national flower of America. To ascertain the respective popularity of these and our other American flowers, and thereby hasten, if possible, a solution of the question, the above little work is published. A postal-card accompanies each book, on which the purchaser is requested to fill out, with full address, his choice, and return it. The result, as it appears from time to time, will be published in the daily papers in different parts of the country, and on Jan. 1, 1890, L. Prang & Co. will mail to every voter the final decision.

— A. C. Armstrong & Son are preparing "The Complete Works of William Wordsworth." They are to be known as the "New Handy Volume Red Line Edition," and will be issued in eight volumes.

— George Brumder, 286 Water Street, Milwaukee, Wis., has just ready the first part of a work on "North American Birds." No efforts have been spared to make this one of the most excellent works on the subject. The colored plates are made after the original water-color paintings by Professor Robert Ridgway of the Smithsonian Institution, Professor A. Goering of Leipzig, and Gustav Muetzel of Berlin. The firm which produced these originals in a highly finished style, Ernst Kaufmann, in Lahr, Germany, and New York, is well known in art-circles for its specialty, chromo-work. Mr. Nehrling is an original writer, not simply a compiler. He has observed the life of our birds in the woods of Wisconsin, where he was born, in the prairies of Illinois, in Florida, Texas, Missouri, and many other States. The work will be in twelve parts, of forty to forty-eight pages reading-matter, and three colored plates, and will be completed in the fall of 1890.

— Swan, Sonnenschein, & Co. have published the collection of early letters of Jane Welsh Carlyle, edited by Mr. D. G. Ritchie. In addition to those of Mrs. Carlyle, the volume includes eleven unpublished letters of Carlyle, dealing chiefly with his studies in connection with the projected history of German literature and his "Cromwell."

— Ginn & Co. announce in the College Series of Latin Authors, Cicero's "Brutus," edited by Martin Kellogg. In the "Brutus" which was composed in 46 B.C., and purports to be a conversation with Atticus and Brutus, Cicero traces the development of oratory among the Romans down to his own time, with critical notices of about two hundred speakers. The long catalogue is relieved of dryness by the dialogue form, the freedom of digression, and by Cicero's fresh and teeming style. Professor Kellogg has edited the work especially for early college-reading. The introduction touches upon points of interest to those to whom Cicero is no stranger, and contains a full conspectus. The notes deal with the subject-matter, historical relations, and diction of the dialogue rather than with the commonplaces of grammar. Parallel passages are freely given, especially from Cicero's other rhetorical works and from Quintilian. The book is believed to be a substantial addition to the apparatus for the intelligent study of one of the most characteristic and valuable works in Latin literature.

— *The Political Science Quarterly* for June, 1889, opens with a study of "Municipal Government in Great Britain," by Albert Shaw of the Minneapolis *Tribune*. The article is based on prolonged and direct investigation, and goes behind the legal institutions to show their actual working. J. Hampden Dougherty describes the movements of the last forty years for amendment of the New York State Constitution, discussing especially the various projects for the reform of our city government. Frederick W. Whitridge writes on "Rotation in Office," advocating a repeal of the four years' law, which he regards as the basis of the spoils system. E. P. Cheyney of Pennsylvania University criticises from a social and economic point of view the decisions of the American courts on conspiracy and boycott cases. Professor J. W. Jenks of Knox College, Illinois, gives a history of the whiskey trust, and its effect on prices. The number contains the usual reviews, by specialists, of recent economic and political literature, and a record of political events continued from the last record published in the *New Princeton Review*.

LETTERS TO THE EDITOR.

A New Chemical Experiment

(which it would not be well to repeat very often).

LATELY, in my lecture to my class on phosphorus and its compounds, I made hydric phosphide in the usual way, by boiling phosphorus in a strong solution of potassic hydrate. That the class might see that phosphorus melted in an alkaline solution would remain in a liquid state after the solution had cooled, I left the pint flask containing the solution *in statu quo* until the next recitation. I had done the same repeatedly, but never before leaving it for so long a time as on this occasion, — from Friday until Monday. On entering the lecture-room on Monday morning, I observed the flask, and remarked, "All right, the phosphorus is still in a liquid condition;" and, mechanically taking up the flask, I gave it a slight shake, when it immediately exploded with a loud report, shattering the flask into minute fragments, and scattering its contents in every direction; the phosphorus, fortunately, instantly solidifying. So, save a slight cut on the wrist, I escaped without injury. It would be interesting to know if any one else ever experienced a like explosion, and the probable explanation of the explosion. A possible explanation is, that the gas had by adhesion become condensed around the phosphorus as the solution cooled, and that, the slight shake overcoming the adhesion, there was a rapid evolution of the gas. It would not be advisable to repeat the experiment without the face and hands and clothing were well protected. In this connection I would urge that it would be well if chemists, on noticing any like dangerous phenomena not laid down in the text-books, would publish the fact for the benefit of the brotherhood, to prevent serious accidents.

I well remember how near I came meeting with a serious accident from the explosion of a large piece of sodium thrown upon water; the old text-books, written when the price of sodium was as great as for potassium, thus rendering the former too expensive to use except in very small quantities, stating that sodium would not take fire like potassium. The explosion of sodium has resulted in the devising of that most brilliant of all chemical experiments, the ice-volcano.

It is not, perhaps, generally known that iodide of nitrogen, if left standing in aqua ammonia for twenty-four hours, will explode while wet; and even when freshly prepared, if partially dried and then scattered over the surface of a tank of water, it will for hours after repeatedly explode on slightly agitating the water. Many years ago I devised a method of exploding with safety a mixture of phosphorus and potassic chlorate, which I give for the benefit of the young experimenter. Place powdered potassic chlorate (no more than will cover a nickel, if exploded within doors) upon a board, and wet it with a solution of phosphorus in carbon disulphide (an inch of phosphorus will dissolve in an ounce and a half of carbon disulphide in a few minutes). In from five to ten minutes, or as soon as the mixture is dry, touch it with a long pole, or even stamp heavily on the floor, and a loud explosion will result.

A quantity sufficient to cover a dollar out in the air will shatter a thick plank, and make considerable of a hole in the ground. I have never experimented with large quantities, but presume that rocks might be thus shattered.

J. R. EATON.

Liberty, Mo., June 1.

Relative Frequency of Letters and Combinations.

IN a recent number of the *Phonographic World* a correspondent asks, "In English composition, (1) what is the relative frequency of the occurrence of the various letters of the alphabet; (2) in what proportion does each letter precede and follow each other letter of the alphabet; and (3) what syllables occur the most?"

In answer to the first question, it may be stated that in a font of type for printer's use, as supplied by type-founders, the different letters are usually supplied in about the following proportion: *e*, 1,200; *t*, 900; *i*, 865; *a*, 850; *n*, *o*, and *s*, 800 each; *h*, 640; *r*, 620; *f*, 450; *d*, 440; *l*, 400; *u*, 340; *c* and *m*, 300 each; *w* and *y*, 200 each; *g* and *p*, 170 each; *b*, 160; *v*, 120; *k*, 80; *q*, 50; *j* and *x*, 40 each; *z*, 20.

Some years ago I undertook to analyze 10,000 words of every-day English, from the editorial columns of twenty leading dailies, 500 words from each, selected from articles in which no undue prominence appeared to be given to any particular word. My object was to ascertain what combinations of two or more letters occurred with greatest frequency. My eyesight failed before my task was half completed; but the result of my labors, as far as they went, may be of interest in connection with the foregoing questions. In 3,500 words, as far as my analysis extended, I found that two-letter combinations occurred as follows: —

	Times.		Times.		Times.		Times.
th	605	is	175	as	111	me	89
in	314	at	173	it	111	ma	88
an	312	or	153	al	110	co	85
of	236	es	128	he	94	be	77
re	232	se	121	ha	93	le	77
er	227	ed	120	ve	92	pr	72
on	226	to	120	de	91	la	71
en	186	ar	117	ou	90	ll	70

This, of course, does not answer the questions asked, but the material furnished may be of some assistance to the inquirer, should he wish to pursue the subject further.

It may be added, that, in the number of words mentioned, the word *the* occurred 250 times; *of*, 180 times; *and*, 144 times; *to*, 79 times; and *in*, 74 times. 918 words occurred only once each, 163 twice, and 65 three times. The three-letter combination *the* (in *there*, *them*, etc., as well as alone) occurred 400 times; *and*, 172 times; *ing*, 114 times.

A very suggestive point to type-writer manufacturers and inventors is the fact that in all these words the letter *z* occurred but 8 times, while *th* occurred 605 times, and *the*, 400 times.

H. J. T.

New York, June 4.

INDUSTRIAL NOTES.

A New Photographic Lens.

THE Messrs. Beck have just turned out of their factory, and Morris Earle & Co., 1016 Chestnut Street, Philadelphia, have received from them, a new combination of their excellent lenses whereby one Iris diaphragm tube is adapted to carry three different sets of lenses, so that a photographer can take 4×5, $4\frac{1}{4} \times 6\frac{1}{2}$, and 5×8 views by means of adapting the three sets of lenses. Messrs. Earle & Co. have also recently received a new four-inch rectilinear, with Iris diaphragm, from the same firm, — the smallest lens they have ever turned out for photographers' purposes. This is meant to take lantern-slide negatives particularly, and is one of the finest lenses ever received from them.

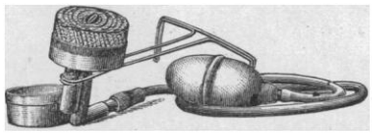
A Beautiful Portfolio of Paintings in Water Colors.

The manufacturers of the well-known Scott's emulsion of cod-liver-oil are issuing the most beautiful portfolio of eight artistic studies (birds and flowers) that has ever come under our notice. This work is worth at least two dollars, but Messrs. Scott & Bowne, with their usual enterprise, have made arrangements

whereby they can supply a copy by mail to any one who will write to them, enclosing twenty-five cents in stamps or post-office order. This is a chance seldom offered, and all lovers of art should avail themselves of it. Mention this paper, and address Scott & Bowne, 132 and 134 South Fifth Avenue, New York.

Magnesium Flash-Lamp.

A lamp for burning pure magnesium has been invented by Mr. E. M. Pine, one of the most successful of amateur photographers, whose flash-light photos were awarded the first prize at the Pittsburgh exhibition in 1888. Recognizing the danger attending the use of the various explosive compounds heretofore used for illuminating, Mr. Pine has succeeded in inventing a lamp for burning



pure magnesium, as shown in the accompanying illustration, after much experimenting, and believes his lamp, for brilliancy, rapidity, and simplicity, as has been pronounced by professional photographers who have tested it, to be a most complete flash-lamp. Its construction is said to insure perfect combustion; and, as magnesium is non-explosive, absolute safety is assured. The lamp is so portable that it can be easily carried in the pocket, weighing about four ounces.

Paris Exposition and International Congress of Electricians.

James W. Queen & Co., Philadelphia, call the attention of college professors and others interested in scientific work, who are intending to visit the Paris Exposition this summer, to the following facts. They have most excellent representatives in Paris who have had the experience of many years in the selection and purchasing of scientific apparatus of every description for college use. In consequence of this, it has occurred to them that it might be a convenience to their patrons when in Paris to be supplied with letters of introduction to these agents.

By means of such letters, those professors who intend purchasing apparatus will have the assistance of competent persons, who are well acquainted with all the prominent makers, their apparatus, and prices. Thus much valuable time may be saved that might otherwise be spent in hunting up dealers and making bargains with them, — a rather unsatisfactory operation, especially to those not thoroughly conversant with the French language. Furthermore, it is often a great inconvenience and annoyance, after apparatus may have been purchased satisfactorily, to attend to the details of shipping and passing through the United States Custom-House "free of duty." James W. Queen & Co. will be pleased to relieve purchasers entirely of all this care, so that they need have nothing to do but select the apparatus.

Another advantage of this arrangement is, that there need be no expenditure on the part of colleges at the time of ordering apparatus. Apparatus ordered through these agents will be forwarded in the firm's weekly shipments as soon as a few pieces are ready, thus saving much time.

Those among the electrical fraternity who expect to attend the International Congress of Electricians will please note that they as well as college professors will find it to their advantage to advise with the firm's agents before buying apparatus for their companies or for themselves personally. Messrs. Queen & Co. do not wish professors or electricians, if they avail themselves of the offer of letters of introduction, to feel under obligations to purchase any thing. They will also be pleased to furnish letters to their agents in England, Germany, and Switzerland, if desired.

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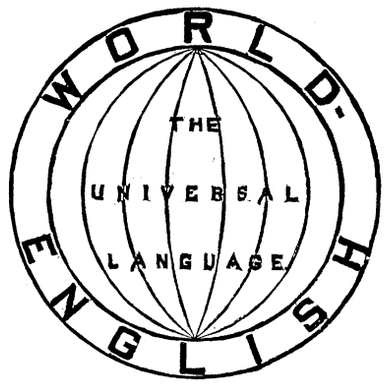
Every one has heard of the butcher who, after a long search for his knife, at last found it in his mouth: so speakers of English have been seeking for a universal language, when, lo! it is in their mouths. The intelligibility of English words has been obscured by a dense mist of letters. This is now dispersed by A. Melville Bell, who has already won a world-wide reputation through his invention of "Visible Speech," the great boon to deaf-mutes. Professor Bell calls this new discovery of his "World-English," and the result is a language which cannot fail to meet with acceptance, and at once supersede the supposed necessity for "Volapük," or any other artificial language. No language could be invented for international use that would surpass English in grammatical simplicity, and in general fitness to become the tongue of the world. It is already the mother-tongue of increasing millions in both hemispheres, and some knowledge of the language is demanded by all educated populations on the globe. Social and commercial necessities require that the acquisition of this knowledge shall be facilitated, and it is believed that Professor Bell's invention has removed the last impediment to English becoming the universal language, for which vague desires have long been entertained, although hitherto only futile efforts have been made.

Ex-President Andrew D. White, of Cornell University, says: "I believe that the highest interests of Christian civilization and of humanity would be served by its adoption. China and Japan would be made English-speaking peoples within fifty years, and so brought within the range of Christianizing and civilizing ideas, in the largest sense. All existing missionary work is trivial as compared with this. For your system would throw wide open those vast countries, as, indeed, all the countries of the world, to the whole current of English and American thought."



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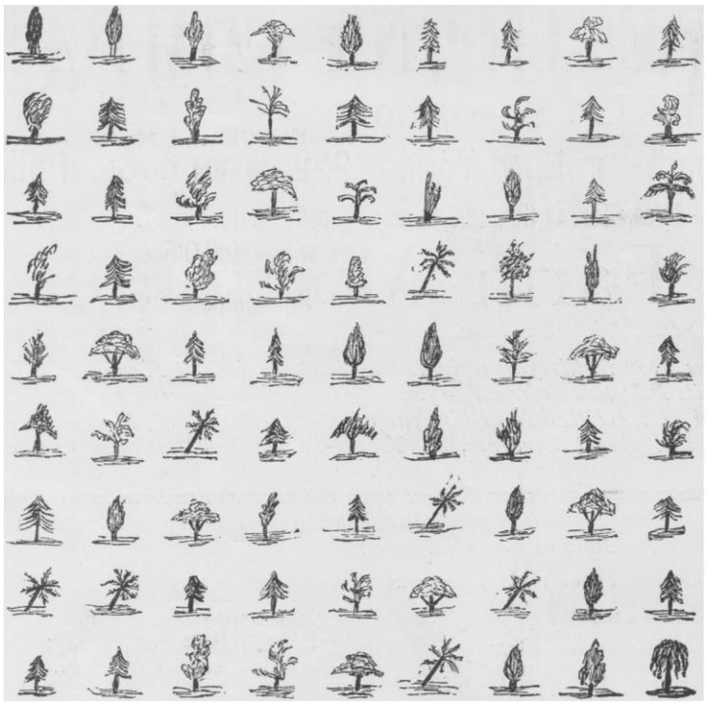

Can any reader of Science solve the following puzzle?

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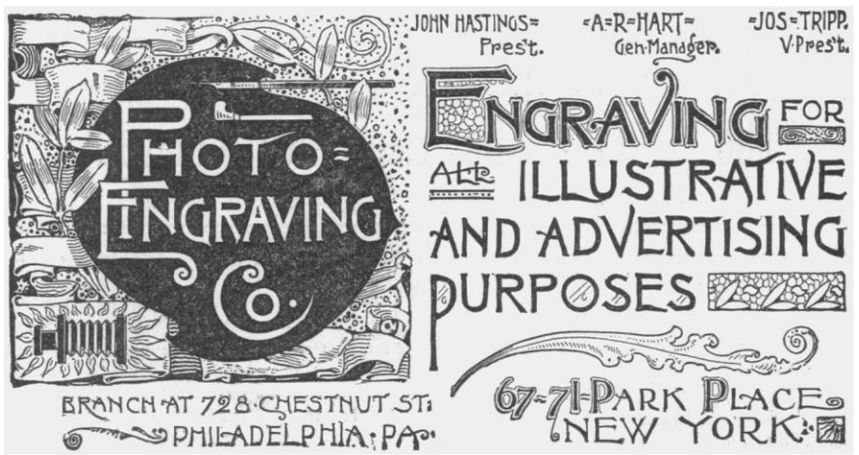

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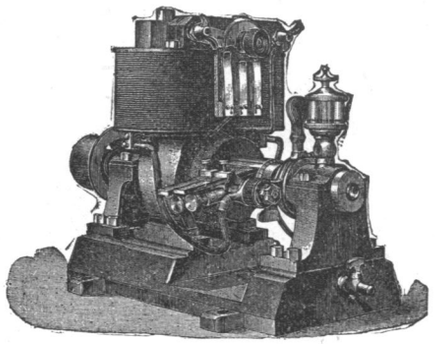

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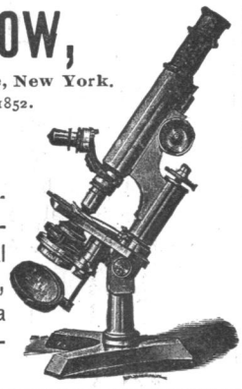

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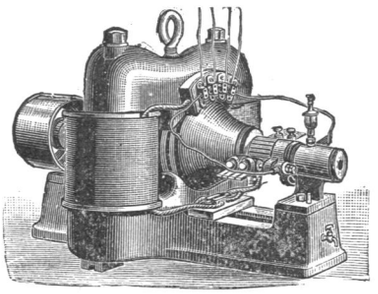

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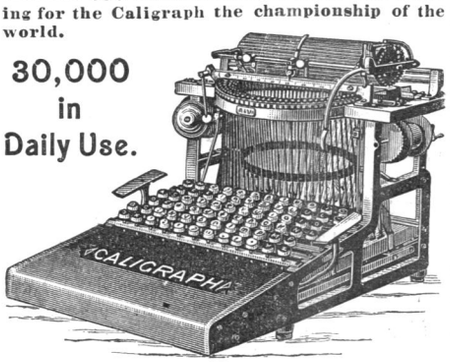

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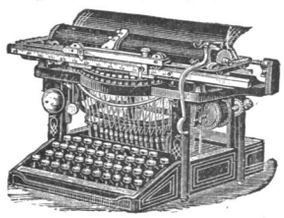

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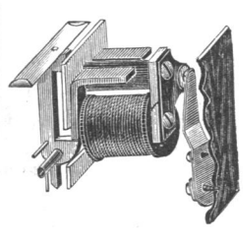

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